Dietary Assessment Methodology for Use in the Special Supplemental Food Program for Women, Infants and Children (WIC)

ACKNOWLEDGEMENTS

This project has been funded at least in part with Federal funds from the Food and Nutrition Service, U.S. Department of Agriculture, under Cooperative Agreement #58-3198-0-048 under the guidance of:

The Department of Maternal and Child Health
Harvard School of Public Health
677 Huntington Avenue
Boston, Massachusetts 02115

The final project report was prepared by:

Jane D. Gardner
Carol J. Suitor
Jelia Witschi
Qiang Wang

Many individuals made substantial contributions of time and effort to assist in the project's development of dietary assessment tools for low-income mothers and children.

The project team wants to express its sincere thanks to the WIC participants who graciously took the time to complete food frequency questionnaires and provide feedback on them. The team also wants to recognize the valuable contributions made by WIC personnel in the Greater Boston Area and to thank them for their cooperation. These people include: Jan Kallio, Laurie Bissett, Janice Kildahl, Maria Serra, Clare McLaughlin and Patrick Healy. Others who gave generously of their time to review documents, give consultation, or participate in field observations were Karen Peterson, Michelle Harris, Patricia Guenther, Stephen Jobe, Cecelia Bennett, Candice Stoiber, Virginia Casey, Jean Wiecha, and Janet Washington. Special recognition is given to Brenda Lisi, Contracting Officer's Representative, and Michele Lawler, of Nutrition and Technical Services Division, Rhonda Kane of the Supplemental Food Program Division, and Ellen Harris of the Office of Analysis and Evaluation at the Food and Nutrition Service, USDA, for their input in this project and critical review of this report.

April 1992

CONTENTS

LIST OF TABLES

LIST OF APPENDICES

DIETARY ASSESSMENT METHODOLOGY FOR WIC

EXECUTIVE SUMMARY

A women's and a children's food frequency questionnaire and accompanying scoring methods (both manual and computerized) to evaluate dietary adequacy were developed for possible use with clients in the Special Supplemental Food Program for Women, Infants, and Children (WIC). The questionnaires were modifications of a women's questionnaire developed and tested by investigators at Harvard School of Public Health. The modifications were based on findings from earlier testing of the women's questionnaire, data from the 1985 1-day sample of low-income women and their children in the Continuing Survey of Food Intake by Individuals, data from a large sampling of State WIC food frequency questionnaires, field observations involving WIC clients and staff, literature reviews, and (to the least extent possible) constraints imposed by the associated manual scoring method. The manual and computerized scoring methods were designed for use by both professional and paraprofessional staff.

The questionnaires were designed to be self-administered by women or by caretakers, in the case of children. A primary concern in the design of the self-administered questionnaires is ease of use by the clients. The women's and children's food frequency questionnaires contain the same 78 food items with four minor exceptions. For each food item, the respondent is asked to mark frequency of intake over the past four weeks in one of nine boxes representing frequencies ranging from zero in four weeks to six or more times daily.

The manual scoring method is based primarily on the food group recommendations as listed in *Dietary Guidelines for Americans* and involves determining whether the number of servings reported meets defined minimums for milk products, fruits, vegetables, meats, and grains [1]. This is accomplished with the use of four templates and identification of food group patterns; however, counting and a small amount of arithmetic are required. The criteria for determining inadequacy can be changed by requiring that intake fall below the minimum number of servings for more or fewer food groups. The criteria could also be changed by changing the defined minimums for servings from the food groups, but this would require revision of the

templates and scoring directions.

The computerized scoring method generates printouts and screen displays that report the daily number of servings from the same five food groups as well as vitamin A rich foods, vitamin C rich foods, sweets, and fats. It also lists the number of servings reported for each food item, alerts the user to potential problems in the data collection, and produces a graph showing the client's indexes of nutritional quality for the nutrients protein; calcium; iron; zinc; and vitamins A, B-6, C, and folate. This computerized analysis uses the 1989 Recommended Dietary Allowances for age and physiologic status, and it uses portion sizes based mainly on medians reported by comparable populations in nationwide surveys [2].

I. INTRODUCTION

A. RATIONALE FOR THE STUDY

The purpose of this project was to develop two food frequency questionnaires and accompanying scoring methods, both manual and computerized, for possible use with women and with children 1 to 5 years of age in the Special Supplemental Food Program for Women, Infants, and Children (WIC). The Food and Nutrition Service (FNS) of the U.S. Department of Agriculture (USDA) administers the WIC Program. Specifically, FNS requested that Harvard School of Public Health (HSPH) expand and modify a food frequency questionnaire that had been developed to screen and classify the diets of pregnant women to allow for screening of women (pregnant, breastfeeding, and non-breastfeeding postpartum) and children 1 to 5 years of age. The HSPH Prenatal Food Frequency Questionnaire (PFFQ) had been developed and validated by Carol Jean Suitor with funding under a dissertation grant from the National Center for Health Services Research and Health Care Technology Assessment and partial funding from a Special Project of Regional and National Significance grant from the U.S. Department of Health and Human Services [3]. The self-administered PFFQ was to serve as the basis for both the women's and the children's questionnaires. The women's food frequency questionnaire (WFFQ) was to be suitable for use by pregnant, lactating, and postpartum non-lactating women and teenagers across the United States. The children's food frequency questionnaire (CFFQ) was to be designed to be completed by the mother or other caretaker of a child aged 1 to 5 years. Although this document treats the development of the two questionnaires and the two types of scoring methods as distinct parts of the project, the activities and findings relating to any one part could and often did influence decisions made concerning the other instruments.

Scope of Report

This report describes the methods used to develop the instruments, presents instructions for their use, provides copies of each instrument, provides manual scoring instructions and models of the scoring templates, describes the software and templates for computerized scoring, compares the results of the two scoring methods, identifies the advantages and limitations of the instruments, and proposes recommendations for future efforts. In addition to this report, FNS was provided the color coded, plastic laminated templates used for manually scoring the questionnaires; the software for computerized scoring; and the plastic templates for entering data for computerized analyses.

The approach to the project was influenced to some extent by activities at USDA. At the time the project began, the WIC program targeted energy and the nutrients protein, calcium, iron, and vitamins A and C. During the course of the project, Federal Register notices announced FNS's intent to review the targets set for nutrients provided by WIC food packages and the content of the packages, thus making it advisable for the investigators to consider approaches that might provide information about other nutrients (e.g., zinc and folate) as well [4,5]. FNS asked the investigators to use the most recent edition of *Dietary Guidelines for Americans* as the basis for scoring [1].

Project Objectives

In summary, this report describes the methods and outcomes for the following objectives:

1. Revise the self-administered food frequency questionnaire for pregnant women (PFFQ) to include lactating and non-lactating postpartum women.

2. Using similar methodology, develop a food frequency questionnaire for screening the diets of low-income children 1 to 5 years of age.

3. Expand the computer software for PFFQ to allow for analysis of the dietary data as reported on the questionnaires developed for women and children.

4. Develop a method to manually score the data collected from the women's and children's food frequency questionnaires.

B. BACKGROUND INFORMATION

This work represents one of a series of activities that grew out of a 1985 U.S. General Accounting Office (GAO) report that stated "program resources could be used more effectively if nutritional risk criteria were uniform" [6]. That report also indicated that inadequate dietary pattern is relatively unreliable as a measure of nutritional risk and holds potential for being overused.

In 1988, the Food and Nutrition Service conducted a survey of State WIC agencies to learn about their use of food frequency questionnaires

and to collect evidence concerning their validity and reliability. The completed questionnaires provided a useful source of information for this project.

Also in 1988, the National Association of WIC Directors and FNS jointly developed standards of practice for WIC nutrition services. One of those standards states that standardized dietary assessment procedures based on current practice should be used consistently in all of a State's local agencies. The criteria for meeting that standard are relevant to this project and thus are listed below:

- The State agency assures that local agencies use a uniform tool.
- A food frequency tool is used when dietary risk is the only certifying risk criterion for a participant.
- Analysis of the diet is based on professionally recognized guidelines.
- There are specific criteria statewide for evaluating dietary adequacy to determine WIC eligibility.
- The State agency documents the rationale for dietary adequacy standards.
- The State agency has standardized procedures for documenting dietary risk assessment in the participant's file.
- There is training for local agency staff on collecting, analyzing, and documenting the dietary assessment data.

In 1989, FNS held a two-day Task Force Meeting on Dietary Assessment [7]. Among the task force recommendations relevant to this project are the following:

- The food frequency tools for children should be limited to children who are at least one year of age.
- The tool should serve several functions: screening for inadequate diet, facilitation of the triaging of patients for services, and

facilitation of general nutrition education.

- The tool should be designed in a paper format that could be self-administered by clients and manually scored/evaluated. In addition, the tool should lend itself to computer application in administration and evaluation.

- Evaluation of the diet using the tool should take two to five minutes by either a paraprofessional or professional.

- Scoring should reflect the nutrients targeted by the WIC program.

- Dietary inadequacy values would be determined by each State and, to assist in that determination, any point values used in scoring would be defined as to how they correlate with the percentage of the Recommended Dietary Allowances for targeted nutrients.

C. OVERVIEW OF THE WIC PROGRAM*

WIC is a grant program administered by FNS of USDA. In 1969, the White House Conference on Food, Nutrition, and Health recommended that special attention be given to the nutritional needs of pregnant women and preschool children. As a result, legislation authorizing WIC was passed in 1972 (P.L. 92-43).

The goal of the WIC Program is to promote the health of program participants during pregnancy and the postpartum period, infancy, and early childhood by providing nutritious foods and nutrition education as adjuncts to good health care. The benefits provided by the WIC Program include:

Benefits Provided by the WIC Program

Supplemental Foods. WIC makes available six food packages that are designed for different categories of participants. These packages contain foods that are good sources of nutrients most likely to be

*Much of this overview was provided by FNS in the Cooperative Agreement for this project.

lacking in the WIC population's diet--protein, iron, calcium, and vitamins A and C. The food items provided include iron-fortified infant formula and cereal, juice, milk, cheese, eggs, peanut butter, and dry beans or peas. These foods are not intended to provide total dietary needs but rather to supplement the diets of participants.

Nutrition Education. The current WIC legislation mandates that the equivalent of at least one-sixth of the funds expended by the State agency for administrative costs be spent for nutrition education in order to assist the individual who is at nutritional risk to achieve positive changes in food habits, and consequently to contribute to improved nutritional status and the prevention of nutritional-related problems.

Access to Health Care. Each WIC agency is to operate as an adjunct to good health care and, as such, is to encourage and refer participants to health care. WIC and the health community work hand in hand to promote better health and nutritional status for a vulnerable population. The program has undergone rapid expansion since its inception. Funding has increased from $20 million in 1974 to a funding level of approximately $2.1 billion in Fiscal Year 1990. Participation has increased from 205,511 persons in Fiscal Year 1974 to about 4.5 million persons in Fiscal Year 1990.

The WIC Program functions administratively at three levels: federal, state, and local. FNS, through its seven regional offices, provides cash grants to designated WIC State agencies for program administration and operations. Regulations governing WIC are promulgated by FNS, and FNS Regional Office staff monitor State agencies for compliance to these regulations. WIC State agencies are responsible for the establishment, monitoring, and reporting of local WIC agency activities to FNS. These State agencies allocate funds to participating local WIC agencies within their areas. Local agencies are often city or county health departments, but also may be any of a variety of public or nonprofit health or human service organizations such as hospitals, maternal and child health groups, or community action agencies. The funds received by local WIC agencies are used to provide specified supplemental foods to WIC participants and to pay administrative costs, including the costs of certifying applicants for eligibility and providing nutrition education and counseling.

To qualify for WIC benefits, an applicant must meet certain eligibility requirements:

Categorical Status. Eligible categories include women during pregnancy and for the first 6 weeks after delivery, breastfeeding women up to 1 year postpartum, non-breastfeeding postpartum women up to 6 months postpartum, infants up to 1 year of age, and children ages 1 up to 5 years old.

Income. The income limit is set by each State agency, but cannot exceed 185 percent or be less than 100 percent of the U.S. Poverty Income Guideline for each family size.

Nutritional Risk. Applicants who meet the categorical and income requirements must be certified by a competent professional authority to be at nutritional risk. Screening for nutritional risk includes anthropometric measurements, blood tests for anemia, health history and dietary assessment. Nutritional risk may be based on medical, clinical, and /or dietary risk criteria.

WIC Program at Local Agency Level

The level of WIC program operation at the local agency level depends on the level of funding that is available. For each local agency, a maximum caseload is determined, depending on its assigned annual funding level and predicted caseload turnover. When local WIC agencies reach this maximum participation level within the available funding, a system of priorities is followed in allocating "slots" to eligible applicants. Seven priority levels are defined, based on the applicant's categorical status and type of nutritional risk condition, as follows:

1. Pregnant and breastfeeding women and infants at nutritional risk as demonstrated by anthropometric or hematological assessment or by other documented nutritionally-related medical condition.

2. Infants up to 6 months of age of mothers who participated in WIC during pregnancy, or of mothers who were at nutritional risk during pregnancy.

3. Children at nutritional risk, as demonstrated by anthropometric or hematological assessment or other documented nutritionally-related

medical condition.

4. Pregnant and lactating women and infants at nutritional risk as demonstrated by inadequate dietary pattern.

5. Children at nutritional risk due to inadequate dietary pattern.

6. Postpartum women, non-lactating, at nutritional risk based on either medical or dietary criteria.

7. Previously certified participants likely to regress in nutritional status without continuation of supplemental foods.

State agencies have the options of creating sub-priorities within priorities and expanding priority levels 2, 4, or 5 to include high-risk postpartum women. In general, the thrust of the existing priority system for WIC eligibility certification is to give precedence to medically-based nutritional risk over risk based on inadequate diet alone for all categories of participants.

II. LITERATURE REVIEW

A. FOOD FREQUENCY QUESTIONNAIRES

The food frequency questionnaire was introduced in 1962 by Trulson and Stefanik as a method of assessing the usual intake of specific foods in large population studies [8]. Other researchers continued to use and to improve the food frequency instrument as a primary tool for dietary assessment, citing its advantages to include high response rate, minimal burden to respondents, and ease of administration (including by nonprofessional staff) [9-14].

During the 1980s, studies to refine, test reliability, and validate the food frequency questionnaire as a dietary assessment tool were much in evidence [15-28], causing them to be referred to as the "dominant theme of the decade" in dietary methodology [29]. The method was being used not only to assess usual intake, but also to analyze food groups, food components, and nutrients [30]. Quantitation of nutrient intakes gathered by food frequencies was reported by several studies [16,19,31,32], and a carefully conducted validation study over a 1-year period indicated that the food frequency questionnaire provided useful information related to both group means and individual intakes of 18 nutrients [31]. Hislop et al. studied misclassification and bias using self-administered food frequency questionnaires mailed to 463 persons to ask about specific food items across four different age periods [33]. The food frequency questionnaire was found to be more reliable for specific food items in the distant past than for the more recent past. Potosky et al. noted that the estimated validity of a questionnaire is higher when compared with three sets of 4-day records rather than just one set [34]. Block et al. found that a self-administered diet history questionnaire produced group means of nutrient estimates closely approximating the values obtained by three 4-day records; correlations for most nutrients were 0.5 to 0.6, similar to those achievable by a single 4-day record [35]. Block and Hartman indicate that while respondent accuracy is the most frequently discussed factor in poor reliability and validity, many other factors which affect reliability and validity of dietary assessment questionnaires are under the control of the investigator and are thus amenable to improvement [36].

Kristal et al. reported the development of an abbreviated method for rapid assessment of dietary intake of fat, fiber, saturated fat, and percent energy from fat [37]. Results of the short dietary questionnaire

administered to 97 women were compared with results from both a food frequency questionnaire and the mean of two 4-day diet records. Correlations for the nutrients studied between the short questionnaire and 4-day records were similar to those between the food frequency and 4-day records, ranging from 0.40 to 0.61. This suggests that the short dietary questionnaire may be useful in situations where more expensive and time-consuming methods are not practical.

Suitor reported the development and testing of a self-administered food frequency questionnaire for use with low-income pregnant women [3]. The instrument was field tested with 295 participants; a subset of 95 women also provided three 24-hour recalls for comparative studies. Correlation coefficients adjusted for measurement error indicated that the questionnaire would correctly identify a high proportion of women having low intake of selected nutrients. Additional reports by Suitor and colleagues present the use of the food frequency questionnaire with low-income, culturally diverse pregnant women to describe supplement use [38] and to calculate an index of nutritional quality (INQ) [39].

The appropriate determination of food portion sizes to represent intake is a continuous concern among investigators. Pao et al. used 3-day reports of 38,000 individuals to determine gram weights of foods eaten per meal or snack [40]. Using these data to compare with traditional or standard servings, Krebs-Smith and Smicklas-Wright determined that traditional serving sizes differ from reported serving sizes for many foods: fruit juices, breads, and cereals are eaten in larger amounts than standard servings while raw vegetables, meats, fish, and poultry vary widely [41]. Hunter et al. reported consumption among women of a wide range of portion sizes of 68 commonly eaten foods [42].

Clapp et al. studied whether the classification of individuals according to usual nutrient intake calculated by using a food frequency questionnaire with standard versus reported portion sizes was the same or different [43]. The authors concluded that replacing reported portion sizes with standard portion sizes to measure overall nutrient intake of a group may cause underestimations of some nutrients and lead to different study results. Mean intakes were lower when standard portion size data replaced reported portion size data for all nutrients studied. Guthrie studied food choice and quantitation abilities of 147 adults and determined poor ability to describe portion sizes without probing or the

assistance of models [44]. Correct estimates (within 25 percent) were made by 8 to 68 percent of respondents; 0 to 67 percent overestimated by more than 51 percent and 0 to 25 percent underestimated by more than 51 percent. Guthrie stated that this suggests the need to provide respondents with help in estimating portion sizes, or to develop methods that do not depend on ability to accurately describe portion sizes.

The ability of WIC participants to estimate portion sizes of 10 commonly used foods displayed in household portions was studied by Webb and Yuhas [45]. A majority of subjects could not give the correct amount for any of the displayed foods and most quantities were overestimated, causing the investigators to conclude that reporting of food intakes may likewise be incorrect, probably overestimated. Overestimation of food quantity was also reported from 8 to 9 year old boys and their mothers [46]. Lewis et al. investigated cola beverage intake in two large national studies and concluded that there was underestimation of intake because of larger portion size among more frequent users [47].

B. DIETARY ASSESSMENT FOR CHILDREN

Morgan suggested that the admittedly difficult task of obtaining dietary records for infants and young children could be improved by streamlining methodology and stating objectives more clearly [48]. Methodology to determine the dietary intake of school-age children has primarily concentrated on the 24-hour recall from the child [49-53]. Diet recordings for 3 days [54] and 4 days have also been described [55].

Some newer techniques for obtaining dietary intake of children have been reported recently. A consensus recall, involving reports from both parents and the child produced more accurate estimates of the observed dietary intake of 34 children (aged 4 to 9.5 years) for one meal on the previous day than did recalls from father or mother alone [56].

Trieber et al. concurrently administered the 24-hour recall and a 3-month food frequency questionnaire on two occasions (1 week apart) to parents of 55 preschool children (mean age 4.25 $\pm$ .59 years) [57]. Test-retest reliability estimates for the food frequency were positive for

all nutrients for all units of expression. The authors concluded that reliable parental estimates can be obtained of preschooler's intakes over a 3-month interval using the food frequency questionnaire. Dietary information gathered about younger children must obviously rely on adult respondents. Recall data obtained from parents or primary caretakers of 30 Caucasian children, aged 24 to 48 months, of middle social economic status, correlated highly with weighed food intake [58]. Most errors occurred in portion size; 96 percent of specific foods eaten by the children were correctly identified.

Basch et al. assessed the validity of mothers' recall of dietary intake of 4 to 7 year old children among first generation Latino immigrant families by comparing intake reported by the mother to home observations made by trained observers [59]. Correlations were high to moderate for calories and most nutrients. At least two-thirds of the children were correctly classified into lowest or second lowest (or highest) quintiles based on mothers' reports. More than one-half of portion sizes were equivalent to those reported while 33.5 percent were larger and 15.5 percent were smaller. There was fair agreement on the number of foods eaten. Eck et al. administered a food frequency questionnaire at 4-month intervals to 108 families to obtain intake of children (mean age 5.2 years) [60]. The one year assessment appeared to compare favorably with food frequency measures of children's intake over shorter periods. The mean correlation between 4-month interval assessments and the one year retrospective assessment was 0.67. This, however, is not an appropriate test of validity as correlated errors no doubt have inflated the correlates.

C. SCORING FOOD FREQUENCY QUESTIONNAIRES

Guthrie and Scheer used a dietary score based on Basic Four food groupings to determine adequacy of intake from 212 24-hour recalls; they concluded that the dietary scoring method was similar to a more complete and time-consuming dietary analysis of actual intake, and in addition, it was simple, quick, and easy-to-use [61]. Kennedy developed a nutrient score using a modified food frequency and four food groups [62]. The nutrient score had no predictive value in identifying women likely to produce low birth weight babies, but the author believed it would have been improved if caloric consumption had

been included. Murphy et al. developed a dietary score from NHANES survey data of 3,436 Mexican-American children based on the number of servings from each of four food groups (milk, meat, bread, fruits and vegetables) [63].

Only two reports were found documenting the use of a manual method of scoring a food frequency questionnaire, namely those of Strohmeyer et al. [64] and Scrimger [65]. A report by Krebs-Smith and Clark described the potential (best-case) validity of a scoring method: it gave directions for scoring once the total number of servings per food group had been determined, but it did not present the method used for assigning the number of servings [66]. Based on 24-hour intakes from 1,431 individuals in the 1977-78 Nationwide Food Consumption Survey and a food guidance system (a food wheel), the scoring system correctly classified 69 to 98% of persons in each population segment. Children were classified most accurately, followed by teenagers and pregnant and lactating women. Information was not provided about the accuracy of this method when used with food frequency questionnaires in the clinical setting.

The scoring method described by Scrimger uses overlays; these make it possible to have the FFQ free of cues and distracting words, symbols, or numbers. The Scrimger method, which involved the use of a calculator, required a mean of 4 ± 2 minutes but Scrimger made a number of suggestions for shortening this time through improved design and instructions [65]. No information was provided concerning the accuracy of the scoring.

The scoring method used by Strohmeyer and colleagues was not described in detail [64]. It was designed for use with a questionnaire that asked women to report the number of times per week that nine types of foods were eaten and to indicate usual portion size. Scoring involved several steps of multiplication and addition and reportedly required an average of 2 minutes. There was no indication that the accuracy of the scoring was verified. These investigators used an

artificial method* to determine how well the scoring method could produce results comparable to those produced by dietary analyses of sets of diet recalls. However, Strohmeyer et al. did not study the extent to which the intakes reported on the form corresponded to the same women's intakes reported by other methods, such as diet recalls. Without such studies, the approach may be of highly uncertain validity: the general public has widely differing perceptions of what foods belong to various food groups, and the thought processes needed to estimate frequency of food group use are highly complex.

*The researchers took data from sets of diet recalls, entered the numbers of servings and serving sizes on the form, and computed the scores.

III. REVIEW OF THE STATE WIC FOOD FREQUENCY QUESTIONNAIRES

A. STATE AGENCY QUESTIONNAIRES

The FNS provided the investigators with a set of food frequency questionnaires, other dietary data collection instruments, and supportive information that State agencies had submitted to them in 1988. A total of 33 States (including Alaska and Hawaii), 1 territory, and 11 Indian nations submitted some type of food frequency questionnaire. An additional 12 States, 2 territories, 7 Indian nations, and the District of Columbia responded that they used diet recalls rather than food frequency questionnaires.

The WIC FFQs were examined to gather information on the following: single foods (foods included, total number), food groupings* (foods included, total number, numbers of foods per grouping); format; instructions; characteristics influencing readability; scoring system (if provided), including categorization by food group; and comparisons between women's and children's questionnaires from the same State.

B. FINDINGS FROM THE STATE WIC FOOD FREQUENCY QUESTIONNAIRES

In the examination of the WIC FFQs, special attention was directed to foods included on children's FFQs that were not included on women's FFQs. Since it was impossible to determine if complete sets of all the versions of the FFQs had been submitted by the State agencies, a quantitative description of differences between women's and children's questionnaires is not appropriate. In the cases in which both a woman's and a children's questionnaire were submitted, however, there were

---

*The term food grouping represents two or more foods listed together as a single item on a food frequency questionnaire. It differs from the term food group, which in this document refers to the components of a system for evaluating diets (i.e., the Basic Four Food Groups or some variation thereof).

generally no differences in the food items included;* in fact, coffee and alcoholic beverages were often listed on the children's questionnaires. This finding provided support for making the food lists nearly identical for the WFFQ and CFFQ.

Scoring Methods

In most cases, the WIC FFQs and supporting materials provided relatively little specific information related to scoring procedures. In the review attention was focused on instructions for scoring, design features that gave some clues concerning the scoring method, the order of presentation of food items and groups, and the food groups themselves.

Instructions for Scoring

Twenty-three of the questionnaires did not include and were not accompanied by information about a scoring method. Those that indicated a method used some variation of a food group approach, examples of which follow:

- "Compare number of servings per day to minimum specified." (Certification might require inadequate amounts of at least one of the major food groups or of one or more of the targeted nutrients).

- "Adjustments may be made in number of servings needed to reach minimum for grains if fortified cereal is eaten." (This implies that it is less likely that a woman will be eligible for WIC based on nutrient inadequacy if she reports eating a WIC cereal).

- "If the intake of a food group is inadequate, make a plus sign and write the number of additional servings needed to meet the recommendation."

- "Evaluation by food servings, based on status." (This implies that pregnant and lactating women can be certified with higher intakes than can postpartum women who are not breastfeeding).

- "When any group has less than its needed points, counsel to improve diet." (Information about the point system was not included).

*Different portion sizes were used for the women and children.

- "Items checked outside of heavy black lines are inadequate." (The form to be completed by the client was marked with heavy black lines that were obviously for scoring purposes).

Design Features

On FFQs, design features that provide information or clues about the scoring method include the scoring directions themselves; information about the recommended number of servings, identification of key nutrients; and the use of lines, headings, spacing, or a combination of these to highlight food groups. Eleven of the WIC FFQs included explicit directions for scoring, and three more stated the recommended number of servings from each food group. Seven identified key sources of nutrients. Twenty-five used lines or spacing to highlight food groups, and several used headings for this purpose.

Although these design features were obviously intended to facilitate scoring by the provider, most of them present the client who is a poor reader with a more difficult task. On the other hand, the explicit directions and the listing of the recommended number of servings give the client who is a good reader information that might influence her responses. (This could potentially place those disadvantaged by limited literacy at an even greater disadvantage than their more literate counterparts.)

Determination of the Number of Foods Per Food Group

Explicit methods for determining the number of servings per food group were seldom provided. When they were, (1) they involved a series of arithmetic processes, or (2) they relied on the respondent's ability to report the frequency with which a group of foods was eaten. The first method generally involved a rather short list of foods. This simplifies the arithmetic and increases the chance that important nutrient sources will be overlooked. The second method is highly questionable because it involves highly complex thought processes. It is notable that the number of food items listed on the WIC FFQs ranged from 15 to 142 with a median of 54.5. However, respondents were asked to report their intake by some kind of sizable food grouping (e.g., breads and cereals) rather than by individual food items; the number of groups or items ranged from 7 to 87 with a median of 18.5.

Order of Presentation

If an instrument is being used mainly for screening purposes, the order of presentation of items can be very useful in reducing the time required to identify those people who have a characteristic that places them at

risk. By inquiring about the most prevalent conditions first, one can minimize the amount of time required to identify those at risk.

Many studies have indicated that eating patterns in the United States often include lower than recommended numbers of servings from the milk group or the fruit and vegetable groups (or both) [67-69]. Thus, placing foods from these groups first would allow quick identification of most women or children with dietary shortfalls. Moreover, foods at the beginning of a FFQ might receive more careful attention than those at the end, when some women may begin to tire.

On the WIC FFQs, there was much variation in the order of presentation of foods and food groups, but animal foods were often listed first. In some cases, decisions about arrangements appeared to be based on space. More often, it appeared that the order of presentation was completely arbitrary. The order in which the food groups are discussed here reflects the order in which they are considered in the FFQs developed for this project. This order facilitates quick identification of women or children who have less than desirable intake from one or more food groups.

Food Groups

In most of the WIC FFQs, foods were arranged according to four or more named food groups. A few used the term "Calcium" to cover milk products; either the term "Protein" or "Iron" to cover flesh foods, eggs, and legumes; and the terms "Vitamin A", "Vitamin C", and (rarely) "Folacin" to cover various plant foods.

Milk Group. WIC FFQs were in general agreement about the foods they included in the milk group, with the following exceptions: approximately half the WIC FFQs included cottage cheese, the remainder did not; three included cream soup. When cottage cheese was included, the portion size that was specified typically ranged between 1⅓ to 2 cups (301 to 452 grams)--much larger than the median portion sizes reported by Pao et al. for 19- to 34-year old women (113 grams) and young children (57 to 85 grams, depending on age).

Fruit and Vegetable Groups. There were many variations on the fruit and vegetable groups. The most common version appeared to be formation of three separate groups: fruits and vegetables rich in vitamin C, those rich in vitamin A, and others. A few WIC FFQs made overt

provision for considering the total contributions of foods that are rich in both vitamins (for example, cantaloupe could be counted both as a source both of vitamins A and C). Some FFQs appeared to be attempting to separate out rich sources of folate.

In several cases, foods were listed inappropriately as rich sources of nutrients. Appropriate listings of rich sources of vitamin A include dark green leafy vegetables, such as spinach and turnip greens -- which provide approximately 700 retinol equivalents (RE) of vitamin A per 1/2 cup serving, and carrots -- which provide approximately 1,900 RE per 1/2 cup. Inappropriate examples include peaches (29 RE for 1/2 cup canned or 47 RE for one whole fresh), prunes (84 RE for 5 dried prunes), broccoli (110 RE for a 1/2 cup serving) and tomatoes (139 RE for 1 raw tomato*). In some cases, the heading used for a food category seemed to be inappropriate: "Vitamin C Fruits" included coleslaw in one, green pepper in another; "Dark green leafy vegetables" (probably intended to identify rich sources of vitamin A) included cantaloupe and mango in one, Brussels sprouts (56 RE of vitamin A per 1/2 cup serving) in another. Some WIC FFQs distinguished fruits from vegetables without focusing on the nutrients they provide; that is also the way that foods are grouped in the USDA/DHHS publication *Dietary Guidelines for Americans* [1].

Protein (Meat) Group. A majority of the WIC FFQs grouped flesh foods (meat, fish, poultry, organs) eggs, dried peas and beans, and nuts (especially peanut butter) in the meat group. Variations include distinguishing between high and low iron "meats", distinguishing between animal and vegetable proteins, distinguishing high-fat meat from others, and including either cottage cheese or all cheese in the meat group (rather than in the milk group).

Bread and Cereal Group. In general, all WIC FFQs included the same foods in the bread and cereal group and did not subdivide on the basis of nutrient content. There are two types of exceptions: (1) three

---

*Twice the median portion size reported by Pao et al [70] for young women. Broccoli and tomatoes were very commonly grouped with foods much higher in vitamin A value.

or more FFQs included starchy vegetables in this group, (2) scoring methods for two or more FFQs allowed extra points for fortified cereal.

Additional Food Groups. Other food groups found on some forms had various names, but the foods appeared to be grouped according to the following characteristics:

High in sugar
High in fat
High in sodium
High in either sugar or fat
High in sugar, salt, or fat, or any combination of these
Beverages
Miscellaneous
Combination foods

Foods included in these groups did not appear to be counted in the scoring for nutrient intake. Among the potentially good sources of essential nutrients listed in such groups were cocoa, pizza, french fries, soup, macaroni and cheese, and other convenience or fast foods.

Only 4 (8 percent) of the 50 WIC FFQs that were submitted showed no clear division of foods by food group.

Other Comments. The scoring methods that accompanied the WIC FFQs provided no evidence that the vitamin A contributions from animal sources were included in the vitamin A score. The vitamin A contributions of milk products, eggs, butter or margarine, and liver are potentially great; indeed, the WIC food packages for women and children provide substantial amounts of vitamin A through some of these foods.

The food group subdivisions used sometimes led to potential problems. For example, a few WIC FFQs listed the same food in more than one place (e.g., broccoli was listed under both vitamin C and vitamin A). No studies have been found to give an indication of the potential effects of such a practice on the responses made on a self-administered questionnaire.

Many of the WIC FFQs or the scoring instructions that accompanied

them implied that there should be an adjustment for portion size. The designated equivalents were not standard across the questionnaires. Examples of equivalents from the milk group included the following: 1 cup milk = 2 ounces hard cheese = 2 cups cottage cheese = 2 cups ice cream. Examples from the meat group include these: 2 ounces meat = 4 tablespoons peanut butter = 4 slices bologna = 1 cup cooked dried beans. Making this kind of adjustment based on equivalents can greatly complicate the scoring process.

IV. DEVELOPMENT OF THE FOOD FREQUENCY QUESTIONNAIRE FOR WOMEN

A. REVIEW OF DATA FROM PFFQ

The validation study conducted by Suitor et al. provided data that were used to identify ways to improve the original Harvard prenatal food frequency questionnaire (PFFQ) [71]. In particular, the completed PFFQs were examined for patterns of responses and contributions of specific foods to total nutrient intakes. Also the diet recalls obtained in that study were examined to determine the types of foods reported. The format of the questionnaire, instructions, and food list were critically reviewed. The questionnaire used in the validation study is in appendix A.

In the study by Suitor et al., the validity of the PFFQ was examined by comparing nutrient intakes estimated from the PFFQ with those estimated from sets of three diet recalls. After adjusting for measurement error caused by the relatively small number of diet recalls, the validity of the usable PFFQs was found to be acceptable for energy, protein, calcium, zinc, iron, vitamin C, and vitamin B-6. It was unacceptable for vitamin A. No other nutrients were studied.

It was found that approximately 18% of the questionnaires were suspect because of unreasonably high estimates of average daily energy intake (>4,500 kilocalories/day) [3]. Inspection of those questionnaires revealed that many of the women had checked frequencies of 4-5 times/day or 6+ times/day for foods for which such frequencies would seem unreasonable (as for example a reported frequency of 6+ times per day for ground beef). This suggests that some women had difficulty in understanding how to complete the questionnaire. The most efficient way to handle such questionnaires is to identify them by visual inspection, to assume that they are not accurate enough to warrant scoring, and to use other methods to determine if the women who completed those questionnaires are at risk of nutrient inadequacies.

The method used in the Suitor study for handling doubly marked or unmarked items is the method proposed in the general instructions for scoring the CFFQ and the WFFQ (see appendix B).

Food List

Review of diet recalls from the Suitor study indicated that macaroni and cheese and spaghetti and sauce were often eaten, but other kinds of

pasta were not. After obtaining similar information from the more representative information presented by Pao [70] and by Block and colleagues, it was determined that substituting those two pasta products for "spaghetti, macaroni, and other types of pasta" and "tomato sauce" would be more informative [18].

Review of the diet recalls also suggested that several foods that are very rich sources of vitamin A contributed to the lack of correspondence between estimates of vitamin A intake obtained from the PFFQs and the diet recalls. For example, a number of the women reported eating liver once per week or one to three times per month, but this food was named in only two of more than 320 diet recalls. From the data available, it could not be determined if this represented over reporting of liver intake on the PFFQ or underestimates of liver use relating to obtaining only three diet recalls per person. Use of carrots and spinach was also reported to be more frequent on the PFFQ than was indicated by the diet recalls.

Based on the review of data, the food list was simplified by deleting some food items and descriptive terms such as "any kind" for milk and "plain or flavored" for yogurt. Some food items were combined; for instance, the three items "tomato, vegetable or minestrone soup", "cream soup or chowder made with milk" and "all other kinds of soup" was changed to two items "vegetable soup" and "other soup". The correlation coefficient of "pancakes" with "syrup" was .83, therefore, the two items were combined and the nutrients of syrup were added to pancakes. Some items were deleted from the list including "asparagus", "mixed vegetables" and "beer, wine or liquor".

Initially, several items (e.g. candy, pudding, jello) were dropped from the WFFQ because their inclusion was not warranted by either frequency of use data or by nutrient content, but they were added back later because of their importance to the CFFQ.

Portion Size

Field observations of the PFFQ suggested that portion size information was not used by most women and served mainly to increase the time they required to complete the questionnaire. For scoring purposes, however, portion sizes must be assumed. The portion size used in PFFQ gave satisfactory results in the validation study with pregnant women. These portion sizes represent, in most cases, the median

weight of portions reported by women aged 19 to 29 years in the second National Health and Nutrition Examination Survey (NHANES II), as reported by Block, and should therefore be suitable for non-lactating postpartum women [73]. No studies have been found that report on change in usual portion size during lactation.

Format

The format of the questionnaire was revised to include the date of birth physiologic status of the woman, and expected date of confinement (EDC) if pregnant. The date of birth is useful for identification of a client when more than one woman has the same name. It is also used to calculate age in the computerized analysis of the questionnaire. The EDC was added at the request of WIC providers.

B. FINDINGS FROM THE CSFII DATA ON LOW-INCOME WOMEN

The 100 foods most frequently reported to be eaten by the low-income women in the 1985 CSFII are shown in table 1. For a description of the methodology used to identify these foods see page 33. These foods are ranked by percent of women reporting at least one use of each food type. This list confirms the suitability of most of the foods included in the PFFQ. No important nutrient source among the top 100 foods is missing from the PFFQ. Most items appearing among the top-ranked foods that were not included on the PFFQ are foods with little nutritive value (e.g., condiments, gravy, and non dairy creamer) or mixed dishes for which no widely-used name applies. Most of the components of the mixed dishes (e.g., potatoes, carrots, dried beans, hamburger) are included in the food list of WFFQ. The CSFII data were used to determine if additional foods could be deleted from the PFFQ without seriously compromising its validity.

For each food category it is possible to identify the form of the food most commonly reported. This information confirmed the choice of foods used in the PFFQ. For example, the data show that whole milk, fried eggs, American cheese, white bread, fried chicken (dark meat), and raw tomatoes are the most common food choices; these were the forms of foods used in setting up the nutrient data base for the PFFQ.

TABLE 1

100 MOST COMMON FOODS CONSUMED BY WOMEN
CSFII 1985 ONE-DAY DATA

GROUP	FOOD4[a]	TOTAL[b]	PERCENT[c]	FOODNAME
1	9241	1142	54.9	soft drinks
2	1111	990	47.6	milk
3	5110	987	47.5	white bread
4	9210	754	36.3	regular coffee
5	8110	728	35.0	margarine, butter
6	9110	706	34.0	*sugar
7	3110	488	23.5	whole eggs
8	9230	472	22.7	tea
9	7511	434	20.9	lettuce, cucumber, onions
10	8310	340	16.4	mayonnaise, salad dressing
11	6121	326	15.7	orange juice
12	7140	323	15.5	white potato
13	5620	307	14.8	rice
14	2522	297	14.3	bologna, sausage
15	1441	294	14.1	processed cheese
16	9254	276	13.3	fruit-flavored drinks
17	7440	261	12.6	*tomato catsup
18	7550	250	12.0	*mustard, pickles
19	5115	245	11.8	rolls
20	7410	237	11.4	tomatoes
21	5120	217	10.4	whole wheat bread
22	7520	209	10.1	beans, string, asparagus, beets
23	2150	202	9.7	ground beef
24	7521	199	9.6	corn
25	2260	195	9.4	bacon
26	7120	191	9.2	potato chips
27	5810	186	8.9	pizza, taco, enchilada, burrito
28	9211	175	8.4	decaffeinated coffee
29	5440	170	8.2	salty snacks
30	7150	169	8.1	mashed white potato
31	7110	168	8.1	boiled or baked white potato
32	2751	160	7.7	hamburger, cheeseburger
33	3210	154	7.4	egg omelet, scrambled egg
34	2523	151	7.3	luncheon meat
35	7522	151	7.3	peas
36	6310	148	7.1	apples
37	5620	145	7.0	cooked cereals, grits
38	8311	144	6.9	mayonnaise-type salad dressing
39	2110	143	6.9	beef steak
40	9140	140	6.7	*jellies, jam
41	2850	134	6.4	gravy
42	5220	132	6.3	cornbread
43	1221	130	6.3	cream substitute
44	7514	122	5.9	lettuce salad
45	9310	120	5.8	beer
46	9130	119	5.7	honey, syrup
47	2210	118	5.7	pork chop
48	2521	116	5.6	frankfurter
49	5221	115	5.5	tortillas
50	1410	114	5.5	cheese, cheddar or American type

[a]First four digits of the seven digit code to identify foods.
[b]The number of the women who chose a food in that group at least once.
[c]There are 2079 individuals. PERCENT = (TOTAL / 2079) * 100.
*Not included on WFFQ.

TABLE 1

100 MOST COMMON FOODS CONSUMED BY WOMEN (continued)
CSFII 1985 ONE-DAY DATA

GROUP	FOOD4[a]	TOTAL[b]	PERCENT[c]	FOODNAME
51	5814	114	5.5	macaroni or noodles with cheese
52	1311	113	5.4	ice cream
53	5320	110	5.3	chocolate cookies
54	5210	107	5.1	biscuits
55	5310	107	5.1	chocolate cake
56	2412	106	5.1	chicken breast
57	4220	106	5.1	peanut butter
58	2231	105	5.1	ham
59	4110	98	4.7	pinto, lima, kidney beans
60	9251	97	4.7	fruit drink
61	2711	94	4.5	chili, beef with gravy or sauce
62	6310	93	4.5	banana
63	7160	92	4.4	potato salad with egg
64	7310	92	4.4	carrots
65	9120	91	4.4	sweetener
66	2413	88	4.2	chicken leg
67	5813	87	4.2	spaghetti, lasagna, ravioli
68	2416	84	4.0	chicken wing
69	2140	81	3.9	beef, roast
70	5352	80	3.8	doughnuts
71	5432	80	3.8	crackers
72	6111	78	3.8	orange
73	9170	78	3.8	candy
74	2415	77	3.7	chicken thigh
75	4120	77	3.7	baked beans
76	2270	68	3.3	pork, spareribs
77	5815	59	2.8	rice mixed dish
78	6410	57	2.7	apple juice
79	7510	57	2.7	celery, cauliflower, cabbage
80	5840	56	2.7	soup
81	6120	56	2.7	grapefruit or lemon juice
82	2714	55	2.6	chicken with gravy or sauce
83	5118	55	2.6	muffins
84	7220	55	2.6	broccoli
85	2610	54	2.6	fish
86	2414	53	2.5	chicken drumstick
87	2615	51	2.5	canned tuna
88	5713	50	2.4	corn flakes
89	2721	49	2.4	beef mixed dish
90	5510	48	2.3	pancakes
91	6313	47	2.3	peaches, pears
92	5323	46	2.2	cookies
93	4121	45	2.2	stewed beans
94	5312	45	2.2	white or yellow cake
95	7514	45	2.2	cabbage salad or coleslaw
96	1121	44	2.1	evaporated milk
97	5613	44	2.1	cooked spaghetti
98	5733	43	2.1	rice krispies cereal, raisin bran cereal
99	2745	42	2.0	tuna salad
100	7521	42	2.0	cooked cabbage

[a]First four digits of the seven digit code to identify foods.
[b]The number of the women who chose a food in that group at least once.
[c]There are 2079 individuals. PERCENT = (TOTAL / 2079) * 100.

C. FIELD OBSERVATIONS OF WFFQ

Field observations were used to gather information on the readability, food list, and format of the questionnaire. Since Office of Management and Budget (OMB) clearance was not required under this cooperative agreement, HSPH could not pose the same question to more than nine persons through the field observations. Even with this limitation, a great deal of valuable information was attained through the field observations.

Sites

Initial contacts for the field observations were made through the Massachusetts State WIC director, who invited sites to participate on a voluntary basis. After initial drafts of the WFFQ and CFFQ were prepared, they were administered in three WIC sites: North Shore in Lynn, Uphams Corner in Boston, and Dorchester House, also in Boston. The racial/ethnic distributions at the three sites are presented in table 2.

TABLE 2

PERCENT DISTRIBUTION OF RACE/ETHNICITY OF CLIENTS AT THE FIELD OBSERVATION SITES

Race/Ethnicity	Site		
	Uphams	Dorchester	North Shore
White, not Hispanic	3	43	39
Black, not Hispanic	53	18	19
Hispanic	30	21	28
American Indian/AL	<1	0	<1
Asian/Pacific	13	18	13
Unknown	0	0	0

The facilities at the three sites vary greatly. The Lynn site, which is affiliated with the North Shore Health Center, has a modern well-lit, spacious building with a large, modern waiting room and private offices for clients to meet with the nutritionists. The Uphams Corner WIC site is located in a store-front on a busy inner-city street, sandwiched between the Food Stamp Program office and the post office, and one block from the affiliating health center. From the street, one enters a small waiting room that is separated from the office cubicles by a locked door. A window allows clients communication with the staff. The nutritionists provide services in windowless cubicles along either side of a central walkway. The third site is at Dorchester House, a multi-service center in a free-standing building where medical care, day care, an elderly lunch program, and other community services are provided. The WIC services are provided in either the large dining/meeting room or a classroom used for day care. The clients sign in and wait at tables while the WIC nutritionist and other WIC staff provide services at another table, all in full view.

Administration of the Women's Food Frequency Questionnaire

North Shore. As a part of routine WIC activities over a period of one day, the receptionist distributed the WFFQ to any prenatal or postpartum clients without instructions. This is the same method as the current WIC tool distribution. The clients fill in the tool and then meet with the nutritionist.

Uphams Corner. The nutritionist recruited the women and asked them to sign a consent form provided by the WIC site. Then either the nutritionist or the investigator gave them oral instructions on how to fill out the WFFQ.* The investigator observed the length of time for completion and difficulties in filling in the form, and interviewed the women to gather information on readability, clarity of directions, and any difficulty completing the questionnaire.

Dorchester House Site. The investigator or the nutritionist recruited women and asked them to sign a consent form provided by the WIC

*The verbal instructions were very brief (less than 1 minute per woman) and focused on putting only one x per food item and on the range of choice in frequency of consumption.

site. After brief instructions the women filled in the questionnaires and provided feedback on ease or difficulty in filling out the questionnaire.

Findings

Since the number of observations was limited to only a few individuals, and the WFFQ underwent minor changes after the field observations, the information described below should be considered to be merely an indication of what the findings might be in large scale testing. In no way should these findings be viewed as generalizable or to represent a sample from which inferences could be properly drawn.

Observations were made on the following:

- When it could be determined, the amount of time used to complete the WFFQ ranged from 6 to 15 minutes with a mean of 12 minutes.

- Two of the women appeared to have difficulty in completing the form. All the women, when interviewed, said the form was easy to complete. With the exception of "squash" for one woman, all the food items were familiar to the women. None of the women could recall foods they ate that were not in the food list.

- The error rate for questionnaires where no difficulty was reported was .02 percent (no response and double marked items).

- Participating nutritionist asked for two additions to the questionnaire:

    1. Expected date of confinement (EDC), and

    2. Date of birth (for identification purposes when more than one woman has the same name)

- Comments from nutritionists:

    1. The listing of several food items rather than the name of a food group (e.g., "fruit") seems to give better information for assessment and education.

    2. They had difficulty in estimating nutrient intake or number of servings using the WFFQ because the foods were not entirely

arranged by food group.*

The following changes in the WFFQ were made as a result of the field observations: the written directions on the form were revised, EDC and date of birth were added, and the column headers for frequency of intake were repeated part way down the page where possible.

*The nutritionists did not have the manual scoring method for the WFFQ at this time.

V. DEVELOPMENT OF A FOOD FREQUENCY QUESTIONNAIRE FOR CHILDREN: ANALYSIS OF DATA FROM THE CONTINUING SURVEY OF FOOD INTAKE BY INDIVIDUALS

A. METHODOLOGY

As recommended by the WIC Task Force on Dietary Assessment [7] and by FNS, the Continuing Survey of Food Intake by Individuals (CSFII) was used as a reference data base. The data set selected for analysis was the 1985 one-day set for low-income women and their children [74]. The main purposes of using this data set were to obtain information on the foods most commonly used by young children and to estimate median portion sizes for foods consumed by young children. Of the four CSFII data sets available, the one selected contained the largest number of children (1,314 children aged 1 through 5 years* compared with 816 children in the 1986 1-day CSFII, and 571 and 306 children in the 1985 and 1986 4-day data sets, respectively). Furthermore, the data set used was the only one in which all data were collected by face-to-face interviews. It was also possible to use the same data set to determine the foods most commonly consumed by 2,079 low income women aged 19 to 50 years.

The variables used for the project included household ID, individual ID, geographic region, age in years, race, date of the interview, food occasion (breakfast, lunch, snack, etc.), food code, food name, and the weight of the food in grams. Because the variable *race* was not identified for any person under age 19 years, the race of the woman in the household determined the assignment of race for the children. In the eight cases in which there was more than one woman in the household and more than one race, the race for the child was coded unknown. Information on food occasion was examined to obtain insight concerning the extent to which food consumption occurred outside of the home and thus, possibly, was not observed by the person reporting the child's food intake.

---

*Although the sample comprises children described as 1 to 5 years of age, the data tapes include data on infants (age less than 1 year of age) and on 5-year old children.

Of the 849 households with children, 267 included more than one child. Since the children in such households were likely to be eating the same foods, and since this might bias the estimates of food use, we randomly selected one child per household. The resulting sample represented 849 children aged 1 to 6 years and included 11,088 food records. (Each food record represents one food from the 24-hour diet recalls.) Children between the ages of 5 and 6 years were then excluded because they are not eligible for WIC benefits. This resulted in a sample representing 716 children and containing 9,261 food records.

Identification of the Most Commonly Used Foods

To identify the foods most commonly consumed across the sample, it was necessary to delete food records for foods eaten more than once in the 24-hour period by the same child; for example, the child may have eaten bread or milk several times during the day. Thus, the foods were ranked on the percent of children using the food at least once that day. This created a subsample of 7,771 food records.

To the extent possible, the food coding system employed by the CSFII was used to group similar foods. This system uses a seven-digit code to characterize foods quite explicitly; however, the use of only the first four or five digits (moving from left to right) allows useful grouping of most foods. For example, the four-digit code 1111 included most forms of milk, and the code 6121 included at least six different types of orange juice.

Using the first four or five digits of the CSFII seven-digit code, a list of 348 groups of food used by children 1 to 5 years of age was compiled. This was followed by visual inspection of the data and the combining of food codes as necessary. For example, it was necessary to combine more than 52 seven-digit codes to account for all the types of ready-to-eat cereal. After making the necessary combinations, the foods ranked from one to 100 represent 191 (55 percent) of the 348 food groupings.

The same general procedure was used to identify the commonly reported foods for the low-income women in the 1985 CSFII one-day data set.

Identification of Median Portion Size for Children

To examine the portion sizes of foods reported for children, data were analyzed for single years of age, for age categories 1 through 2 years

and 3 through 4 years, and for all four years combined.

The distribution of the data were examined by means of box plots, scatter plots, and other descriptive statistics using SAS [75].

B. FINDINGS FROM THE CSFII DATA

Food Use by Children

The 100 foods (ranked by percent of children for whom at least one use of each food type was reported) eaten by the low-income children in the CSFII are shown in table 3. Items appearing among the top-ranked foods that were not included on the earlier Suitor version of the women's questionnaire include catsup, popsicles, popcorn, ham as an entree (rather than as a sandwich meat), pickles, fruit cocktail, and certain mixed dishes for which no widely-used name applies. Ham had been pretested for inclusion on the Suitor women's questionnaire, but it was deleted because it led to considerable double counting (as pork and as cold cuts). Some of the items (e.g., mustard and catsup) are consumed in such small portion sizes that they do not warrant space on the CFFQ. As for the women, most of the major components of the mixed dishes are included in the CFFQ as individual food items.

Portion Size

Examination of the descriptive statistics from the CSFII data concerning portion size revealed the following:

- The gram weights recorded for a majority of the food items corresponded to discrete units of the food, e.g., the standard weight of a slice of cheese or of a 1/2 cup serving. This implies that very young children typically consume standard portions without leaving any waste or that the data collection method did not include probes for waste.

- A number of foods were eaten by so few children that median portion sizes were likely to be unrepresentative.

- Data were skewed toward high values, some of which were implausible (e.g., 725 grams [about 3 cups] of cooked cereal).

TABLE 3

100 MOST COMMON FOODS CONSUMED BY CHILDREN AGED 1 TO 5 YEARS CSFII 1985 ONE-DAY DATA

GROUP	FOOD4[a]	TOTAL[b]	PERCENT[c]	FOODNAME
1	1111	716	84.3	milk
2	5110	422	49.7	white bread
3	8110	266	31.3	margarine, butter
4	9241	238	28.0	soft drinks
5	3110	220	25.9	whole eggs
6	9254	220	25.9	fruit-flavored drinks
7	6121	187	22.0	orange juice
8	9110	179	21.1	*sugar
9	7140	154	18.1	white potato
10	2522	148	17.4	bologna, sausage
11	5620	134	15.8	rice
12	4220	133	15.7	peanut butter
13	6310	129	15.2	apples
14	7440	129	15.2	*tomato catsup
15	1441	127	15.0	processed cheese
16	9140	120	14.1	*jellies, jam
17	5620	119	14.0	cooked cereals, grits
18	7120	118	13.9	potato chips
19	9230	100	11.8	tea
20	2521	98	11.5	frankfurter
21	7520	97	11.4	beans, string, asparagus, beets
22	5440	95	11.2	salty snacks
23	7521	93	11.0	corn
24	2150	88	10.4	ground beef
25	5320	88	10.4	chocolate cookies
26	6410	86	10.1	apple juice
27	8310	86	10.1	mayonnaise, salad dressing
28	6310	82	9.7	banana
29	1311	80	9.4	ice cream
30	5115	80	9.4	rolls
31	9130	78	9.2	syrup, honey
32	5813	76	9.0	spaghetti, lasagna, ravioli
33	3210	75	8.8	egg omelet, scrambled egg
34	5814	74	8.7	macaroni or noodles with cheese
35	5713	73	8.6	corn flakes
36	5810	71	8.4	pizza, taco, enchilada, burrito
37	7150	69	8.1	mashed white potato
38	2260	64	7.5	bacon
39	5120	62	7.3	whole wheat bread
40	5730	60	7.1	kix and lucky charms cereal
41	7511	60	7.1	lettuce, cucumber, onions
42	2523	59	6.9	luncheon meat
43	5840	58	6.8	soup
44	7110	57	6.7	boiled or baked white potato
45	7522	56	6.6	peas
46	7550	56	6.6	*mustard, pickles
47	9174	54	6.4	hard candies, gumdrops
48	2414	52	6.1	chicken drumstick
49	5432	52	6.1	crackers
50	2751	51	6.0	hamburger, cheeseburger

[a]First four digits of the seven digit code to identify foods.
[b]The number of the children who chose a food in that group at least once.
[c]There are 849 individuals. PERCENT = (TOTAL / 849) * 100.
*Not included on CFFQ.

TABLE 3

100 MOST COMMON FOODS CONSUMED BY CHILDREN AGED 1 TO 5 YEARS (continued)
CSFII 1985 ONE-DAY DATA

GROUP	FOOD4[a]	TOTAL[b]	PERCENT[c]	FOODNAME
51	2850	49	5.8	*gravy
52	2210	46	5.4	pork chop
53	5221	46	5.4	tortillas
54	9251	46	5.4	fruit drink
55	6111	44	5.2	orange
56	7410	44	5.2	tomatoes
57	5712	43	5.1	cheerio, cocoa puffs cereal
58	9170	43	5.1	candy
59	2711	42	4.9	chili, beef with gravy or sauce
60	7310	42	4.9	carrots
61	9161	42	4.9	*popsicle
62	2110	41	4.8	beef steak
63	5324	41	4.8	vanilla cookie
64	5510	41	4.8	pancakes
65	5733	41	4.8	rice krispies cereal, raisin bran cereal
66	4110	40	4.7	pinto, lima, kidney beans
67	1410	39	4.6	cheese, cheddar or American type
68	5220	39	4.6	cornbread
69	5310	39	4.6	chocolate cake
70	1183	38	4.5	cocoa flavored beverage powder
71	8311	38	4.5	mayonnaise-type salad dressing
72	2413	37	4.4	chicken leg
73	6313	36	4.2	peaches, pears
74	4120	35	4.1	baked beans
75	5732	34	4.0	rainbow brite cereal
76	2416	33	3.9	chicken wing
77	5323	33	3.9	cookies
78	5410	33	3.9	graham crackers
79	2231	31	3.7	ham
80	5734	31	3.7	frosted flakes, corn pops cereal
81	5210	30	3.5	biscuits
82	5352	30	3.5	doughnuts
83	7160	30	3.5	potato salad with egg
84	1151	29	3.4	chocolate milk
85	5740	29	3.4	total cereal, trix cereal
86	2140	26	3.1	beef, roast
87	2714	26	3.1	chicken with gravy or sauce
88	2610	25	2.9	fish
89	7514	25	2.9	lettuce salad
90	9150	25	2.9	gelatin dessert
91	1312	24	2.8	ice cream bar or sandwich
92	2412	22	2.6	chicken breast
93	2721	22	2.6	beef mixed dish
94	5613	22	2.6	cooked spaghetti
95	2731	21	2.5	beef stew with potatoes and vegetables
96	2756	21	2.5	bologna sandwich, frankfurter
97	5430	21	2.5	crackers
98	4121	20	2.4	stewed beans
99	5814	20	2.4	pasta mixed dish
100	6411	20	2.4	grape juice

[a]First four digits of the seven digit code to identify foods.
[b]The number of the children who chose a food in that group at least once.
[c]There are 849 individuals. PERCENT = (TOTAL / 849) * 100.
*Not included on CFFQ.

The project team concluded that the median portion sizes were strongly influenced by the survey methods and in some cases were unreasonably high. Therefore, if the data were suspect because they were based on a small number of children, or because the values were very large or both, supplementary sources of information were consulted before assigning gram weights to portions. These sources included the report *Foods Commonly Used by Individuals* [70] (which includes mean and median portions for children aged 1 to 3 and 4 to 6 years, obtained using data from the 1977-1978 Nationwide Food Consumption Survey), Patricia Guenther of USDA's Nutrition Monitoring Division (who in a personal communication confirmed a tendency to overestimate the portion sizes of meat in the CSFII), data compiled by Gladys Block on median portion sizes consumed by young women (for comparative purposes), and tables of suggested serving sizes for children [73]. The portion sizes assigned to the foods (in grams) are given in table 4.

C. FIELD OBSERVATIONS OF CFFQ

Administration of the Children's Food Frequency Questionnaire

Uphams Corner. (See site description page 28) The nutritionist or one of the project team gave instructions to the mothers of children aged 15 months to 4 years; then the mothers filled in the CFFQ in the small waiting room. There were several children in the room and many distractions as persons were called to pass through the locked door to receive services. Two women did not complete the CFFQ because they were called into the WIC office; they declined to complete the form after their appointment.

Dorchester House. (See site description page 29) This field observation was used to compare frequency response columns on the draft CFFQ (nine choices per item) with the same food list having a three-column frequency response: "not very often or never", "number each week", and "number each day". Each respondent was asked to complete the first page of each version of the CFFQ.

TABLE 4

FOOD PROTION SIZE IN GRAM WEIGHT ASSIGNED TO FOODS ON THE WFFQ AND CFFQ

Food Name	Portion Size		
	Women	Children	
		1-2 years	3-4 years
Milk	270	183	183
Hot chocolate	28	28	28
Cheese, plain, in sandwiches	28	21	21
Yogurt	198	117	117
Ice cream	90	67	67
Pudding	119	80	120
Orange	122	131	131
Orange juice	217	124	155
Apple juice	255	186	186
Other fruit drinks	270	124	155
Banana	102	91	102
Apple or applesauce	138	106	138
Grapes	75	75	75
Peaches	80	80	80
Strawberries	47	47	47
Cantaloupe	127	68	68
Watermelon	440	120	120
Pineapple	80	47	47
Raisins	28	14	28
Corn	83	42	64
Peas	52	42	42
Tomatoes	62	31	31
Peppers	18	9	9
Carrots	70	29	29
Broccoli	70	46	46
Green beans	40	35	35
Spinach	70	27	27
Greens	72	27	27
Squash, orange or winter	156	49	60
French fries, fried potatoes	115	42	57
Potatoes	99	72	80
Sweet potatoes or yams	70	49	60
Cabbage or coleslaw	40	37	77
Lettuce salad	55	37	37
Salad dressing or mayonnaise	15	5	12
Chips (potato, corn, others)	42	13	20
Nuts	15	15	15
Cookies or brownies	25	22	22
Cake or cupcake	66	30	30
Pie (pumpkin, etc.)	140	37	37

TABLE 4

FOOD PROTION SIZE IN GRAM WEIGHT ASSIGNED TO FOODS ON THE WFFQ AND CFFQ (continued)

Food Name	Portion Size		
	Women	Children	
		1-2 years	3-4 years
Other Pie	112	66	66
Jello	90	90	90
Chocolate candy	32	18	27
Other candy	15	18	18
Tea	180	120	180
Soft drinks	246	124	186
Sugar-free soft drinks	246	124	186
Baked beans or chili beans	128	83	128
Other dried beans, peas	85	58	58
Rice	113	87	87
Spaghetti or other pasta	310	192	227
Pizza	140	72	77
Macaroni and cheese	168	121	168
Hot dogs	44	45	45
Hamburgers	84	58	58
Canned tuna	28	28	28
Cold cuts	60	49	49
Peanut butter	16	16	16
Bread, toast, or rolls	25	25	25
Margarine or butter	10	5	5
Chicken or turkey	79	62	62
Pork chops	84	39	56
Steak or roast beef	108	56	56
Fish	85	48	56
Liver	84	42	42
Sausage	54	28	28
Bacon	16	16	16
Hot cereal or grits	180	154	234
Cold breakfast cereal	28	21	30
Donut	43	38	43
Sweet roll or muffin	57	44	58
Pancake	33	33	33
English muffin or bagel	50	25	25
Biscuit	28	19	19
Cornbread or tortillas	56	51	56
Vegetable soup	270	122	244
Other soup	217	122	241
Crackers	15	12	12
Eggs	46	46	46

The order of presenting the scoring methods was alternated. At Dorchester House, the observations were made in a classroom with tables placed in a large square. Seven women filled out the CFFQ while waiting for vouchers, four women declined to participate although they had children in the appropriate age range. The women signed a consent form, were given instructions for the first CFFQ, completed it, were given instructions for the second method, completed it, and then were asked to compare the two methods.

Findings from Field Observation

As had been the case in the study by Suitor et al. [71] and as reported by Scrimger [65], the field observations made during this project provided evidence that some women who can read will have difficulty completing the questionnaire for herself or her child. For example, one woman could read all the names of the foods but was unable to choose a frequency response even with assistance. She could verbalize how often her child ate each food, but she could not identify the appropriate column for her response.

The time required by the mothers to complete the draft version of the CFFQ ranged from 8 to 12 minutes. Of the 336 food items (across all the questionnaires*), there were seven food items with a double or a blank response. Four of the response errors involved a doubly marked food item adjacent to an unmarked food item. This problem appears to occur more often for food items at the bottom of the page.

None of the women had additional food items to add to the food list, all of them could read each item, and one asked, "What is cold cuts?". The mother of a 14-month old child commented that her child ate very few of the foods, and two responded that their child had "natural milk" (meaning whole milk).

Without hesitation, all the women said that it was easier to use the form where they only put an **x** as opposed to writing in numbers of servings. One woman was in a hurry and did not appear to want to fill out the forms; she put check marks on both the form requesting numbers and

*The number of food items was higher during the field observations than that of the final version of the questionnaire.

the one requesting checks. Two women indicated that they needed a place to mark between "not very often, never" and "each week". One wrote in "sometimes", and the other had difficulty choosing between "not very often, never" and "each week". The format developed by Willett [76] and tested previously by Suitor et al. [71] appears to be much easier for the women to use then does a format that requires them to write in a frequency in the proper column. However, some women had difficulty following down a column to record a frequency response. To reduce the chance of making errors, it appears desirable to repeat the column headings mid-page.

VI. DEVELOPMENT OF A MANUAL SCORING METHOD

A. BACKGROUND INFORMATION

The specifications given for the questionnaire development called for rather quantitative results to be obtained in a relatively short time (10 minutes or less). Not only was the questionnaire to target energy and the nutrients of special interest to WIC (protein, calcium, iron, vitamin A, and vitamin C), but the scores were to be usable for the following categories of WIC participants: pregnant women, lactating women, postpartum women, and children 1 to 5 years of age.

Workshop on Manual Scoring

On February 4, 1991, a workshop was held at Harvard School of Public Health to explore possibilities for realistic manual scoring methods applicable with the PFFQ. The workshop generated a list of possible approaches to scoring, resulted in the identification of logistical problems and constraints to be considered in developing a scoring method, and alerted the project team to unrealistic expectations for manual scoring methods.

The discussion at and following this workshop made it obvious that there are many different approaches to scoring. A number of the methods were eliminated from consideration when FNS advised the project team to base the scoring method on a food group approach rather than a nutrient approach.

A food group approach requires some method of estimating the number of servings of food consumed from each food group over a given period (e.g., per day or per week). Such a method must be arithmetic for a FFQ that asks for servings per week and servings per day. With this restriction in mind, the project team looked for ways to minimize the amount of arithmetic required. The intent was to save providers' time and to reduce error.

Challenges in Manual Scoring Methods

Based on discussions at the workshop, discussions by the project team, review of the literature, review of the WIC FFQs, and the guidance provided by FNS, the project team identified several major challenges related to the development of a manual scoring method.

Limitations of the Accuracy of Shortcut Methods. Unless a computer is involved, shortcut methods invariably cause loss of accuracy in the estimation of nutrient intake. Decreasing the number of food items on

a FFQ decreases the chance of identifying either important nutrient sources in an individual's diet or high calorie foods that may be limiting the intake of rich sources of nutrients. The relatively small number of foods included on a FFQ ordinarily must represent a diverse diet, and many assumptions must be made about the nutrient values of those foods.

Omitting estimates of portion sizes reduces the chance of identifying participants whose intake is higher or lower than expected because the portions they consume differ markedly from the norm. The need to keep the scoring system quick and simple means that arithmetic needs to be minimized and consequently that a score or a scoring category will cover a fairly wide range of nutrient intakes.

Constraints Imposed by the Format of PFFQ. The format of PFFQ severely limits manual scoring possibilities. Two features account for this: (1) frequencies are expressed in ranges, so that it is impossible to distinguish between two and four servings per week, for example; and (2) the format is not designed to facilitate tallying or computation of the numbers of servings per day. Although work by Scrimger [65] indicated that women could successfully complete FFQs with formats different from that of PFFQ, field observations and earlier preliminary work at HSPH suggest that the format of the validated PFFQ is easier for women to use than the others [71]. If this is the case, changing the format might decrease the validity of the questionnaire.

Constraints Imposed by the Arrangement of Foods . Foods on the PFFQ are arranged only partially by food group. At the beginning of pretesting in 1987, all foods were arranged in food groups as had been done on the Willett questionnaire [19]. However, the pretesting led to rearrangement of the order of some foods to facilitate the women's recall and interpretation and to reduce the possibility of double counting. Cases in which the sequence of foods is not food-group based include sandwich fillings, bread; salad, salad dressing; soup, crackers; and a variety of breakfast foods from the meat and grains groups (regardless of fat or sugar content).

The order of the fruits and vegetables in the PFFQ is, in part, related to their frequency of use and in part to the need to reduce the chance of misinterpretation. Foods that are high in vitamins A or C are not

necessarily in close proximity.

Categorization of Mixed Foods. Mixed foods (especially spaghetti with sauce, macaroni and cheese, and pizza) are an important part of the U.S. diet, and these foods should be counted in two or more food groups. Such foods cannot be accommodated with simple scoring strategies; rather the judgment of the nutritionist or dietitian is needed.

Lack of a Definition of Nutrient Inadequacy. The lack of a standard definition of nutrient inadequacy poses a daunting challenge for developing any quick and easy method of scoring diets. Flexibility requires the kind of detail provided by calculating total nutrient intake from all foods consumed, as can be achieved easily only with computerized methods. Moreover, there are inconsistencies in the application of dietary criteria for determining eligibility for the WIC program across nutrients as well as across States. In particular, more stringent requirements are placed on iron than on other nutrients. Having 67 percent of the RDA be the cutoff point for iron would mean that *all* pregnant women and young children could automatically become eligible for WIC with relatively little error, but the methods for estimating adequacy of iron intake are more stringent. On the other hand, methods for estimating calcium or vitamin C intake usually indicate that an individual is eligible at intakes that are much higher relative to the Recommended Dietary Allowances.

Cost. Many of the proposed strategies to facilitate a lower manual scoring time have a higher cost than methods in current use. Such strategies might include color coding on questionnaires, overlays, differences in shading, or pressure sensitive paper. Without documentation of the overall cost savings or of improved ability to identify individuals at nutritional risk, the implementation of some of these strategies may be blocked.

Adapting the Method for Different Population Groups. If some percentage of the RDA were used as a standard of comparison, target nutrient intakes would differ among the categories of potential WIC participants, within the child category for vitamin A and perhaps vitamin C (a 5-milligram increase at age 4), and within the lactating group for vitamin A and perhaps vitamin C (a 5-milligram decrease after 6 months of lactation).

Two obvious ways to deal with this challenge are to use an arithmetic score with different cutoff points or to use population-specific tools that facilitate identification of important shortfalls (above or below a certain level). Requiring the use of several tools would have some distinct disadvantages: it would require the provider to use the correct tool, and it would make it more difficult for State agencies to have flexibility in setting their own cutoff points. Using the same general scoring method for each of the population groups is highly desirable because it simplifies training, promotes ease of use, and is likely to reduce error.

In making decisions related to meeting the above-named challenges, the following statement in the request for this project was considered: "After identifying and examining dietary assessment methodologies, the instrument developed by Harvard School of Public Health . . . emerged as the only tool that had been developed for and tested with a low-income group categorically eligible for the WIC Program." Substantive changes in the food items, their sequence, or the format of the PFFQ could change its validity in unknown ways. For these reasons, substantive changes in the PFFQ were ruled out and scoring options were pursued instead.

B. THE SCORING METHOD

Based on Minimum Number of Servings By Food Group

FNS advised HSPH to develop a scoring method based on a food group approach rather than a nutrient approach and to use the food groupings included in *Dietary Guidelines for Americans* [1].

After considerable systematic trial and error, (as too complex, error prone, and time consuming) methods were ruled out that would produce numerical scores having a range that is dependent on the numbers of servings of foods reportedly eaten (as exemplified by the scoring systems devised by Krebs-Smith and Clark [66] and by Scrimger [65]. Instead, the project team focused on developing a method that allowed relatively quick identification of women and children whose intake of foods from one or more food groups was above or below predetermined levels.

It was clear to the project team that using an entirely arithmetic approach was impractical in the clinical setting. The procedure required

would be to tally the number of foods in each of the weekly and daily columns by food groups and use the following formula:

$$\text{mean servings per day} = \frac{X_1 + 4X_2 + 8X_3 + 20X_4}{28} X_5 + 2X_6 + 4X_7 + 6X_8$$

where the X_s are the frequencies in the nine columns.

Instead, a pattern matching approach was developed to simplify the scoring process.

Pattern matching relies on knowing what combinations of column subtotals for each food group provide a predetermined minimum number of daily servings from that group. A finite number of combinations of the nine subtotals can result in a daily total that equals or exceeds a predetermined minimum. The concept underlying the pattern matching is as follows:

- The total number of daily servings from a food group is computed by finding the sum (subtotals) of each of the monthly, weekly, and daily frequencies; converting the monthly and weekly frequencies to daily ones; and summing the results.

- The patterns of subtotals shown on the scoring templates were derived by determining which combinations would equal or exceed a predetermined minimum. When doing the computations, the lower level in a range was used. For example, four different foods consumed 5-6x/week would provide at least 4 x 5 = 20 servings/week or 20/7 = 2.8 servings/day. This exceeds the daily minimum of two specified for fruits, but is less than the three specified for vegetables. In some cases, a large proportion of responses in the two columns on the far left (never and 1-3 x/month) can make it impossible to achieve the recommended number of servings.

- By examining the patterns on the templates, one can identify when the minimum is exceeded, intake provides less than the minimum, or further pattern matching is necessary to determine eligibility.

- The sequence of the patterns was selected to facilitate efficient scoring.

- When the number of food items in a food group and/or the specified minimum number of servings is large, as is the case for fruit and grain groups, a very large number of frequency combinations can result in meeting the specified minimum. Since this makes pattern matching time consuming and highly subject to error, the use of an arithmetic approach to augment the pattern matching is necessary for the fruit and grain groups.

- Decreasing the number of daily servings required to meet the minimum would simplify the manual scoring somewhat, but it would also decrease the number of people eligible for WIC based on dietary intake. Increasing the number of daily servings, as for grains, would complicate the scoring considerably.

The project team's initial efforts at developing the procedure included both helpful and confusing strategies. Originally, the color coding was a part of the questionnaire itself. This had the advantage of making the questionnaire quite attractive, and the design made it more difficult to recognize that some of the boxes were used for scoring purposes. In the search for alternatives to color (to minimize cost), various shapes were used in place of color. This was much less attractive and greatly complicated the wording of the instructions and the preparation of templates. The first attempts at preparing templates and instructions used a step-by-step approach that was more confusing, less efficient, and less economical of space.

The following daily minimums were used in formulating the scoring system for both children and women (regardless of physiologic status). They are based on *Dietary Guidelines for Americans*; deviations and special considerations are explained below [1].

Food Group	Minimum Number of Servings Daily
Milk products	**2**
Fruits	**2**
Vegetables	**3**
Meats	**2**
Grains	**6**

To minimize the amount of arithmetic required, the project team developed a scoring system involving color coded overlays used to match patterns of food frequencies (see appendix C for models of the templates). Because of the large number of combinations that would result in intake equaling or exceeding the specified minimums for vegetables and for grains, limited multiplication and addition are required for scoring these two food groups. No evidence was found that pattern matching has been used as a scoring method for food intake.

Revisions of the Questionnaires to Accommodate Manual Scoring

Because the manual scoring method requires extra space on the questionnaire for scores, the project team examined the data to determine which foods, if any, might be deleted from the list without losing essential information. Three items--cottage cheese, tomato juice, and cream soup--were deleted; all were eaten by a very small percentage of women and children in CSFII and did not make substantial contributions to nutrient intake in the portion sizes consumed.

To simplify scoring, a block of foods comprising mainly snacks and desserts was moved to the previous page. The meat and cereal groups were not separated because of concerns about how that might affect the validity of the questionnaire. To the extent that foods are arranged by food groups, the order of presentation in the questionnaire is as follows: (1) milk products, (2) fruits, (3) vegetables, (4) snack foods and desserts, and a combination of (5) grains and (6) meats and legumes. This arrangement has the following advantages:

- Milk products are the easiest group to score, and they are under-consumed by many women, especially those belonging to minority groups. This means that it would be possible to identify many of the

eligible people very quickly, without scoring the entire FFQ.

- According to a review of the literature, fruits and vegetables are ordinarily consumed in amounts well below the recommended levels. Thus, the second and third steps in the scoring process allow quick identification of most of the remaining people likely to be eligible.

Assumptions Concerning Portion Sizes

As was true of the original PFFQ, the WFFQ and the CFFQ do not ask the respondent to provide estimates of portion sizes. This greatly simplifies the task for the respondent and for the person scoring the form. When a scoring method is developed and evaluated for such a FFQ, some assumptions about portion size are required. The portion sizes that had been used for the Suitor PFFQ were retained for the WFFQ [71]. Where changes were made in food items, median portion sizes for young women from the second National Health and Nutrition Examination Survey were used. The portion sizes assigned on the CFFQ represented median portion sizes for the young children from CSFII, with a few exceptions.

It is important to note that median portion sizes in many cases do not correspond with recommended or "standard" portion sizes. For example, the median portion size for fruit juice for women would be considered by some to be two standard servings, but the median portion size for cheese is small relative to the amount that is equivalent in calcium content to a serving of milk.

Correspondence With Servings Specified in Dietary Guidelines for Americans

Milk Products. The dietary guidelines recommend 2-3 servings per day for milk products. The median portion size for milk for women is 270 grams; thus two servings daily would provide the equivalent of slightly more than two standard servings. Several milk-containing foods are not used in the scoring, including milk added to cereal (which the computer program adds automatically), ice cream, and pudding.* This suggests that the direction of error is toward underestimation of the number of standard servings of milk.

*These foods are not ordinarily consumed in amounts that would provide more than 0.25 to 0.5 milk equivalents, and the project team ruled out the use of extra computations to take this into consideration.

Fruits. The dietary guidelines recommend 2-4 servings per day for fruit. Median portion sizes for fruits are generally comparable to or somewhat smaller than those indicated in the guidelines; they are larger for juices. This suggests that the direction of error is toward underestimation of the number of servings of fruit if juice is the primary form of fruit consumed. Juice drinks are not counted as fruits when scoring.

Vegetables. The dietary guidelines recommend 3-5 servings per day of vegetables. With the exception of potatoes, median serving sizes are generally smaller than those indicated in the guidelines. The manual scoring method does not count dried peas and beans as vegetables. To do so easily would require major rearrangement of the foods. The contribution of legumes, pizza, vegetable soup, and spaghetti with sauce to vegetable intake would require a more time-consuming approach involving the nutritionist. The review of WIC FFQs suggests that these foods are not ordinarily considered in establishing WIC eligibility.

Meats. The dietary guidelines recommend 2-3 servings per day of meats. The intakes of several foods ordinarily scored as meats are not scored in the manual scoring method. These foods include hot dogs, bologna, sausage, and peanut butter. Since the median portion sizes of these foods provide very low amounts of protein, iron, and other essential nutrients, including them could potentially lead to serious overestimation of intake from the meat group.

Grains. The dietary guidelines recommends 6-11 servings per day of grains. The number of servings chosen for the cutoff point is 6. Median portions of many of the foods in the grains category provide the equivalent of two or more servings. This is true, for example, of pizza, spaghetti with sauce, rolls (often hot dog or hamburger buns) and rice.

Overestimation and Underestimation

Despite the apparent problem with underestimation of the number of servings by food group suggested above for the milk and fruit groups, the estimation of energy and nutrient intake provided by the PFFQ tested by Suitor et al. were *higher* than those obtained from sets of three 24-hour diet recalls [71]. In other words, there was a tendency for women to over-report their total intake when checking off food use on a questionnaire containing many food items. The mean and median portion sizes reported by the women completing the diet recalls were

similar to those used in computing the food frequency scores. The largest differences in estimates of median intakes from the two dietary methods were for vitamins A and C as shown below:

Nutrient	Diet Recall Median	Food Frequency Median*
Energy, kilocalories	**2125**	**2386**
Protein, grams	**91**	**90**
Calcium, milligrams	**1169**	**1247**
Iron, milligrams	**13.7**	**14.9**
Vitamin A, international units	**4769**	**9887**
Vitamin C, milligrams	**108**	**160**

Data from Block et al. [35], obtained from higher socio-economical status subjects, indicate comparable overestimation of intake of vitamins A and C by food frequency questionnaires. The larger the number of food items on a questionnaire, the greater the chance of overestimation.

These observations suggest that underestimation of food intake is unlikely to be a problem with the WFFQ and CFFQ. The use of relatively high levels of fruit and vegetable intake as the standards helps reduce the chance of inappropriate decisions about diet adequacy and subsequent denial of eligibility for the WIC program; it may be appropriate to set relatively high levels of fruit and vegetable intake as the cut-off point standards.

Changing Cutoff Points

The scoring method presented in the report does not lend itself easily to the use of different food group cut-off points for different physiologic groups (e.g., for postpartum nonbreastfeeding women compared with breastfeeding women). Different cut-off points would require the use of different sets of templates for women by physiologic status--greatly

*Estimates using only questionnaires for which energy intake was less than 4,500 kcal/day. See Suitor et al. [71].

complicating the scoring process. Moreover, because of the frequency intervals on the questionnaires, the degree of refinement in the scoring is severely limited (e.g., the questionnaires themselves do not allow discrimination between frequencies of 2 to 4 times per week or of 2 to 3 times per day). To set different eligibility criteria for different physiologic status, a shortfall in only one food group might establish eligibility for pregnant and lactating women, while a shortfall in two or more food groups might be established as the criterion for postpartum, nonlactating women.

C. FIELD OBSERVATIONS OF THE MANUAL SCORING METHOD

Methods

Completed PFFQs from the earlier study by Suitor et al. provided data used in testing the scoring methods [71]. Responses on those earlier questionnaires were transferred to revised WFFQs and CFFQs. Nine questionnaires were then copied in quantity and distributed to WIC staff, the project team, and nutritionists participating in the scoring trials.

Four different completed copies of the CFFQ and five completed copies of the WFFQ, the scoring templates, and written instructions for scoring the questionnaires were supplied to each of participants in the field observation of the scoring methods. Each participant was asked to score all the questionnaires following the instructions provided and to record the time required for each questionnaire on the front page. A brief questionnaire was used to elicit comments on the clarity and completeness of the general instructions for scoring, the content of the instructions on the templates, and their opinions on how much time it would take on average for staff to score the WFFQ or CFFQ given they were provided training and had some experience.*

Scoring Times

Table 5 displays the correspondence of manual scoring times by type

---

*These providers did not have the advantages of a training session but were instructed to call the project team should they want additional instruction.

of scorer (project team versus other). The average time required for manual scoring was 4.6 minutes. The first questionnaire took 15 minutes for some scorers who had the written general instructions, but no training. However, all of the scorers reduced the scoring time to less than 5 minutes after they had scored the first four questionnaires. All respondents estimated that less than 5 minutes would be required for staff to score these questionnaires if they had training and some experience.

TABLE 5

MANUAL SCORING TIME IN MINUTES BY PROJECT TEAM AND OTHERS

Participants		Range (Min)	Mean (Min)
Project Team	1	1 - 8	3.6
	2	3 - 6	3.3
	3	Not available	4.8
Other	4	3 - 7	3.3
	5	1 - 15	4.2
	6	5 - 15	7.1
	7	2 - 7	4.1
	8	5 - 20	6.6

Accuracy

Among the manual scorers there was 100 percent agreement on scoring (**X** or —) the milk products and fruit (67 total scoring efforts). There was a 4 percent error (3 out of 67) on both the vegetables and meats. The grains were scored in total agreement in only 3 of the 9 questionnaires; this lead to the discovery of an error on the template that was subsequently corrected.

VII. DEVELOPMENT OF THE COMPUTER SOFTWARE (WIC ENTER)

A. BACKGROUND OF SOFTWARE PROGRAM

The WIC ENTER program is a revision of the ENTER program used to analyze the paper copy version of the PFFQ. Several changes were made in the data base and software design to accommodate the two food frequency questionnaires (WFFQ and CFFQ) and to provide client identification information for WIC program use. The documentation for WIC ENTER is in appendix D.

B. CHANGES IN DATA BASES

The following changes have been made in the data bases:

- Nutrient data were extended to include folate.

- The nutrients for specific foods were updated based on revised nutrient data bases. Where the USDA Nutrient Data Base for Standard Reference, release 5, Microcomputer Version (the principal data base for the original software) did not have updated values or any values for the nutrients included (such that other sources of nutrient data were required), nutrient data from the USDA Dietary Analysis Program or from the revised Handbook No. 8 was substituted.

  These entries were corrected for portion size. Nearly all data handling has been accomplished via computer transfer and computations (with the exception of the last step, which required special formatting for the C language program). Thus, the chance of transcription errors has been minimized.

- A new nutrient data base was created using the above nutrient data sources and the portion sizes established for children in two age groups.

- Recommended Dietary Allowances were updated to the 1989 values for women and for children 1 through 4 years of age. The categories of the RDA are as follows:

Women's RDA		Children's RDA	
Females	11-14 years	Children	1-3 years
	15-18 years		4-6 years
	19-24 years		
	25-50 years		
	51+ years		
Pregnant			
Lactating	1st 6 months		
	2nd 6 months		

- Food items and the corresponding nutrient data were deleted to match the new questionnaires.

- The order of food items was changed to accommodate the manual scoring methods.

- The vitamin A unit of analysis was changed from IU to RE.

C. IMPROVEMENTS IN SOFTWARE DESIGN AND ANALYSIS

The following improvements were made in the software design and analysis program:

- Provisions were made to execute the women's and children's programs separately or from the same program with a menu to select the appropriate data base. A disk operating system batch file is used to provide an easy way to access either of the programs. This design makes revising the programs much easier.

- The first screen display shows the program's name, WIC ENTER, in large letters and moving graphics to attract the user's attention. The screen display also serves as the top menu to let users access the women's program or child's program or to quit easily by hitting the **Y** or **N** key to answer corresponding

questions.

- The second screen display shows a brief introduction to the corresponding program about source data, data file created by the program, available analyses and so on.

- The program provides some concise introductions to command keys and the coding method employed in the program.

- New fields, including date of birth (DOB) for both women and children and physiologic status and expected date of confinement (EDC) for women, were added into the data files. The information contained in these fields is used by the program to refer to the correct RDA. In order to simplify data entry, the program prompts the user to enter EDC only if the physical status of a woman is pregnant.

- All entered dates are checked for logical errors including unreasonable date, date of birth (DOB) greater than date of session and EDC less than date of session. Age is calculated by the program and checked against the designated age range, which is 11 years or over for pregnant women and 1 through 4 years for children. If the program detects any foregoing error it displays an informative error message and prompts the user to re-enter a date.

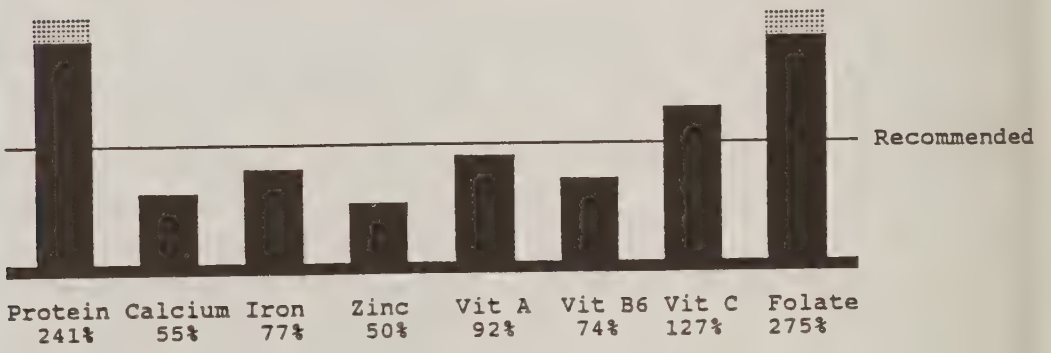
- The program was expanded so the analysis of the nutrient data could be displayed on the screen as well as printed. Analyses include the mean servings per day for nine food groups, the number of food items selected, the number of items double marked and without any mark, a bar graph of the INQ for eight nutrients, and an estimate of total calories per day (as shown below). In addition, it produces a list of the number of servings reported for each food item.

MEAN SERVINGS PER DAY BY FOOD GROUP

Food Group	Servings per day
Milk products	2.3
Fruits	0.7
Vegetables	3.9
Breads and cereals	2.8
Meats and dried peas and beans	1.9
Vitamin A-rich food	0.4
Vitamin C-rich food	0.2
Sweets	2.9
Fats	2.2

Items selected 57
Items without response 1
Items with multiple checks 1

NUTRIENT DENSITY COMPARED TO STANDARD 1 (RDA)



Total estimated calories 1312

Field Observations of WIC ENTER

Some of the same nutritionists who used the manual scoring method were provided a copy of WIC ENTER, instructions for its use, and templates to aid in data entry. They were asked to use the program WIC ENTER for scoring each of the questionnaires and to record the time required.

The project team members independently scored the questionnaires using both methods. The *correct score* is the score obtained when procedures are followed correctly (without errors of addition, or--in the case of the computer-generated score--of transcription).

Data entry using WIC ENTER takes a mean time of 4.5 minutes for persons with limited computer skills. Even with the very limited observations made for this report most individuals could enter a questionnaire in 4 minutes after having entered data from five

questionnaires.

Plastic templates assist in assigning the correct code for frequencies when entering data using WIC ENTER (see appendix D for a paper copy of templates). The program allows for correction of errors; it is not known how many corrections individuals made, but at completion of a total of 45 questionnaires by five persons, less than 1 percent of the food items had transcription errors. Comparing the manually scored and WIC ENTER scored food groups on the same nine questionnaires showed agreement in all the food groups except meat. WIC ENTER estimated the number of servings to be greater than estimated by manual scoring. The manual scoring method is likely to underestimate as all of the foods are not included in scoring.

Using data from a previous study, 25 WFFQ's were scored with the manual scoring method and with WIC ENTER. The two scoring methods showed agreement in all the food groups on all the questionnaires with two exceptions. On one questionnaire the meat group scored minus (—) using the manual scoring method although WIC ENTER indicated 2.0 servings. The manual scoring method would underestimate compared to WIC ENTER as fewer foods are included in the scoring. On another questionnaire the manual scoring method provided a minus (—) whereas WIC Enter indicated 2.9 servings. The difference was due to a reported frequency of 12 eggs per week; this amount has less influence on total servings in the manual scoring method.

In order to allow the reader an opportunity to see the same questionnaire scored manually and with WIC ENTER included in appendix E are a WFFQ and a CFFQ scored by the two methods.

VIII. FINAL RESULTS AND CONCLUSIONS

A. THE FOOD FREQUENCY QUESTIONNAIRES

Two nearly identical food frequency questionnaires have been developed for low-income women and children ages 1 to 5 years.

Advantages of the Questionnaires

The FFQs developed as a part of this project have a number of advantages, as listed below:

- Food frequency questionnaires more accurately reflect individual dietary patterns with less personnel and time expenditures than do other methods of measurement.

- The WFFQ is based on a self-administered instrument that had undergone validation studies using a sample of low-income pregnant women, many of whom were WIC participants or eligible for WIC [3]. A copy of the validated Harvard questionnaire (PFFQ) is submitted with this report to facilitate identification of the changes made (appendix A). The questionnaire had since undergone several modifications for improved readability [77].

- The food items on both the CFFQ and WFFQ represent foods commonly reported by participants in national surveys.

- The food lists are identical for the WFFQ and the CFFQ with minor exceptions (e.g., "tea", "orange" and "raisins" on the CFFQ are "coffee or tea", "orange or grapefruit" and "raisins or prunes" on the WFFQ).

- No knowledge of food grouping systems or nutrient content is required to complete the questionnaires.

- The number of foods is sufficiently high to provide a sound basis for nutrition education activities; thus, the questionnaires can serve the dual roles of screening and education.

- There is minimal overlap of food items, thus reducing the possibility of double counting.

- The amount of reading required is kept to a minimum.

- Standard conventions are used for capitalization, rather than using all upper case letters.

- Phonetic spellings are used for potentially difficult words (e.g., baloney rather than bologna).

- Simple names are listed before more difficult ones on a line (e.g., salad dressing or mayonnaise, rather than the reverse).

- The design is attractive; strategies used to facilitate manual scoring do not make the form look more complicated. Furthermore, the arrangement of the questionnaire promotes ease of response.

- For 53 of the 78 food items (rows), only one food is listed.

- Heavier vertical lines are used to indicate when the time period is changing (i.e., from monthly to weekly and from weekly to daily).

- Column headers are repeated where necessary to assist with proper alignment of responses.

- The respondent can mark frequency of use in a range rather than being required to give a precise number. The column headings are repeated mid-page to reduce the chance of making errors.

- Based on the earlier work by Suitor et al. [71] and on limited field observations during this project, it is estimated that a majority of women can complete the questionnaire independently, in less than 15 minutes under typical circumstances (e.g., in a busy WIC office or clinic).

- The questionnaires are objective and nonjudgmental; no clues suggest 'appropriate' or 'inappropriate' intake.

Limitations of the Questionnaires

The questionnaires have a number of limitations that should be clearly understood:

- They are much less practical if they must be administered orally by a staff member to women who cannot read or cannot manage the column format for responses; the amount of staff time required is unlikely to be justified by the result.

- Brief (one minute) verbal instructions are needed; if one observes the respondent fill out the first three items, those having difficulty can be spotted. This conclusion is in agreement with the findings of Suitor et al. [71]. Recommended verbal instructions are provided in appendix B.

- Some women who can read at the sixth-grade level appear to be unable to correctly interpret what is required in completing this type of questionnaire or have a different sense of time resulting in unreasonable responses. When this problem exists, it is likely to cause response problems regardless of the written dietary measurement technique used. However, while dietary information gathered in this situation is unlikely to be useful for certification, it may be very useful for identifying which foods the woman or her child is willing to eat if these foods are available to the family.

- Based on findings from the work of Suitor et al. [71], it is considered unlikely that the CFFQ and WFFQ provide an accurate assessment of vitamin A intake. Modifications were made to try to reduce this problem, but it was not possible in this project to test their effectiveness.

- The effectiveness of FFQs as a screening instrument is affected by the definition of nutritional risk and the prevalence of scores below a specified cutoff point in the population being examined [71]. For iron and zinc, nearly all low-income pregnant women will have intakes less than 67 percent of the 1989 RDA and the FFQ will not be highly discriminating.

- The suitability of the FFQs for certain ethnic groups, especially Southeast Asians, Mexican Americans, Cuban Americans, American Indians, and various islanders is unknown, even with the adaptations suggested under "Recommendations" at the end of this report.

- It is possible that some respondents will answer questions reflecting the present or immediate past versus the designated period of four weeks.

- Mistakes may occur as result of placing check marks inaccurately; staff time will be needed to quickly check for completeness and duplication.

B. MANUAL SCORING METHOD

A manual scoring method that identifies women and children who have met or not met the minimum number of servings for milk products, fruit, vegetables, meats and grains has been developed. The scoring system uses four color-coded templates and pattern matching of frequencies. Very limited observations show that the scoring can be done in less than five minutes with few errors. Training sessions and experience are likely to reduce the time needed to score the questionnaire as there are several appropriate short cuts in this method.

The scoring mechanism can be used to determine eligibility based on criteria of inadequacy of intake in one or more food groups. States can alter eligibility for different categories of children or women based on specific food groups or number of food groups with inadequate intake.

C. COMPUTERIZED SCORING METHOD

Computer Software
WIC ENTER

The software WIC ENTER is designed specifically for use with the WFFQ and CFFQ for data entry and analysis. The data entry takes less than five minutes and allows for screen display or printout of mean servings per day for nine food groups, the indexes of nutritional quality for eight nutrients -- that is, the estimated nutrient density compared with the nutrient density achieved when the RDAs are met at the energy level specified for the physiological group, mean servings per week for all eight nutrients, mean servings per week for each of food items on the questionnaire, codes for mismarked food items, and client identifier information on every

page. The calculated percent of the RDA achieved is not reported since the estimates are likely to be highly misleading with this method of data collection analysis.

Computerized Analysis

The main limitation of the computerized analysis is the need to enter the woman's responses to the questionnaire using WIC ENTER. Although a person who is moderately experienced requires only about five minutes to enter the results from a single questionnaire, and a skilled person can complete the task in three minutes or less, this represents an extra task that requires time and introduces the possibility of transcription error.

The project team considers self-administered, computerized food frequency questionnaires to be a much more promising approach for gathering dietary data from low-income women. The rationale is provided under conclusions.

D. CONCLUSIONS

The conclusions and suggestions that follow are based on information obtained in earlier studies, analyses of data from a large sampling of WIC FFQs, field observations of the submitted instruments involving WIC clients and staff, literature reviews, and constraints imposed by manual scoring methods.

Testing and Future Evaluation

There is a clear need for testing of questionnaire formats and of the recall of dietary information using subjects drawn from the population groups served by WIC. Smith, Jobe, and others have presented models for such testing [78-80], but their subjects have, in general, been much more socio-economically advantaged than those served by WIC. Information gathered through such testing might help identify strategies for improving the completeness and accuracy of recall and clarify expectations concerning the accuracy of recalled dietary data.

If determined appropriate and feasible, the HSPH instruments could be evaluated for validity. As recommended by the WIC Task Force on Dietary Assessment, the HSPH instruments would be

validated against a standard reference, (e.g., multiple dietary recalls), along with another set of existing tools to compare performance between the two sets of tools).

Should FNS wish to propose tests of validity of the HSPH instruments, careful consideration must be given to the logistic problems involved in collecting multiple dietary recalls over a short time period from low-income women as compared with women from more advantaged groups. In general, repeat diet recall interviews cannot be planned to coincide with clinic visits and must therefore be conducted at the participants' homes. The use of telephone rather than face-to-face interviews when possible simplifies the process somewhat [71]. However, it should be recognized that Suitor achieved a 60 percent completion rate for sets of three 1-day diet recalls only by employing intensive efforts including:

- placing calls (or calling back) at times convenient to the women, often at night and on weekends and holidays;

- repeating the placement of unanswered calls at a variety of times for at least seven attempts (busy signals did not count as attempts);

- making home visits to women without telephones, with seven day-time attempts if necessary.

All these contacts were made by Suitor, eliminating problems that arise when a person who has not been introduced to the subject tries to make a contact. Locating or reaching the woman by telephone often was difficult because of shared telephones, disconnected telephones, and language barriers with other household members; doing so in person was hindered by lack of apartment numbers in many buildings, by sudden change in residence, and by locks on buildings with no system for alerting the occupants other than shouting. In many areas it would be exceedingly difficult to recruit interviewers to visit women in their homes for this purpose.

Of the 160 women randomly selected for diet recall interviews, it was impossible to make any contact with 20 percent of them and incomplete sets of diet recalls were obtained from an additional 20

percent. Attempts to obtain more than three diet recalls from the women in that study would no doubt have resulted in further loss to follow up--perhaps to a very serious degree.

The collection of diet recall data should occur in close proximity of time to the completion of the FFQ; otherwise, because of the rather high possibility that food behaviors change somewhat over the course of pregnancy, the intake that is reflected by the FFQ might be quite different from that reflected by the diet recalls.

Customizing the Instruments for Specific Needs

Customizing the FFQs to reflect local eating practices should be undertaken only after careful consideration of numerous practical matters and with a clear understanding of (1) the extent to which the FFQs already incorporate ethnic foods, (2) elements of food frequency questionnaire design, and (3) necessary changes in WIC ENTER.

Assuming that the scoring method will remain the same regardless of the questionnaire version, the practical matter of greatest concern related to customized FFQs involves proliferation of different types of questionnaires in a given setting. In many urban areas, each local WIC program serves several cultural groups. Thus, clinic personnel might need to handle six or eight different forms rather than just two. There is also a problem of FFQ selection because of diversity within cultural groups. For example, a non-Hispanic woman may be associated with a Puerto Rican household and consume Puerto Rican foods. Some Mexican Americans eat no more Mexican-American foods than do their non-Hispanic counterparts. Suitor observed these kinds of inconsistencies frequently when collecting 24-hour recalls from 160 low-income pregnant women living in three different geographical areas of Massachusetts [71].

The questionnaires as developed make considerable provision for ethnic foods in two ways: by naming them, usually in combination with another food or foods (e.g., hot cereal or grits; baked beans, chili beans, or refried beans), and by including many of their components (e.g., other dried beans and tortillas). Nearly all the foods of possible nutritional importance to ethnic groups that appeared in the CSFII data were included in some way in the CFFQ

or the WFFQ.* Among the absent foods are lamb and venison (commonly eaten by some tribes of American Indians), fruit cobbler (reported by some blacks), and a few fruits and vegetables.

The PFFQ was developed in Spanish for use in a prior study. The WFFQ and CFFQ could also be developed in Spanish with very careful translation recognizing that the various ethnic groups use different words for some foods.

The number of different kinds of fruits and vegetables eaten in the United States and its territories is large: in the WIC food frequency questionnaires submitted by state agencies to FNS, more than 42 fruits and 64 vegetables were listed. It is unreasonable to include a complete list of fruits and vegetables on a food frequency questionnaire; such a list would increase the chance of over reporting, make it more difficult and time-consuming to complete the questionnaire (which could lead to other problems), and greatly increase the complexity of manually scoring the questionnaire.

Consequently, efforts to customize the questionnaires should follow these guidelines, keeping changes to a minimum:

- If an item contains more than one food, and it is known that one of those foods is seldom if ever eaten by the population group being served, delete the extra food (e.g., for a southeastern black clientele, change "hot cereal or grits" to "grits", and change "cornbread or tortillas" to "cornbread").

- If a food item is reported in a population and the desired substitute makes little contribution other than energy, make the change as desired (e.g., substitute "fried bread" for "donuts").

- Have a list of supplementary items about which to question the client after the scoring has been completed. The fourth page of

*Because of the way in which the CSFII data set was coded, it was impossible to identify foods of importance to the different groups of Hispanics.

the questionnaire has space for the addition of these questions.

Improving the Quality of Food Frequency Questionnaires

Regardless of whether there is further testing or evaluation of the instruments submitted with this final report, WIC FFQs used in States should strive to meet certain quality standards. Table 6, "Check List for Dietary Data Collection Instruments", provides guidelines that can assist in the development of food frequency questionnaires.

TABLE 6

CHECK LIST FOR DIETARY DATA COLLECTION INSTRUMENTS

☐ **Does the list of food items represent foods commonly reported by the clientele, along with a small number of readily available foods that are very rich sources of some of the nutrients of interest?**

☐ **Is the questionnaire free of the names of food groups (e.g., WIC juice, vegetables) as items? (This helps eliminate guesswork by those women who don't know what is included in a group or how to count multiple items.)**

☐ **Is the number of foods sufficiently high that the questionnaires provide a sound basis for nutrition education activities?**

☐ **Has overlap of food items been avoided? (This reduces the possibility of double counting.)**

☐ **Is the amount of reading kept to a minimum?**

☐ **Are standard conventions used for capitalization? (The use of all upper case letters makes word recognition and reading more difficult.)**

☐ **Is the type sharp and clear?**

☐ **Is the design simple and attractive?**

☐ **Do the strategies used to facilitate manual scoring add to the attractiveness of the form rather than making it look more complicated?**

☐ **Is the questionnaire designed for ease of use by the client rather than by the health care provider?**

☐ **For all, or nearly all, of the items (rows), is only one food listed? (Exception: If the question is of the type, "Did you eat any of these foods yesterday? [Yes or No]", listing more than one food may be highly acceptable.)**

☐ **If the questionnaire asks about food use over different periods of time (e.g., monthly, weekly, and daily), is a method used to help the client recognize the shift from one to the other? Does the arrangement of responses provide for a consistent increase or decrease in frequency? The following example does not; it is an illustration of an arrangement that is <u>not recommended</u>.**

Per day	Per week	Per month
1 2 3 4 5	1 2 3 4 5 6	0 1 2 3

☐ **Are strategies used to assist with proper alignment of responses?**

Planning for Expanded Monitoring of Specific Nutrients and Other Food Components

Recent publications [81,82], urge Americans to moderate their dietary intakes of fat, cholesterol, sugar, and sodium and to increase their intakes of food sources of fiber. Although current federal regulations for the WIC program do not address these nutrition concerns specifically, it is possible that this will change. Indeed, many of the food frequency questionnaires from State WIC agencies had special categories for foods high in fat, sugar, and sodium--apparently for use in nutrition education.

A means of monitoring intakes of fat and fatty acids, cholesterol, sugar, sodium, and dietary fibers in the diets of WIC participants is an important future consideration. Such monitoring could serve as a specific aid in nutritional counseling, particularly in adhering to *Dietary Guidelines for Americans* [1]. Since a number of foods in the WIC package (such as eggs, cheese, and whole milk) are relatively high in fat and cholesterol as well as being excellent nutrient sources, it would be important to develop clear guidance concerning the nutrition messages related to those foods.

These food components are not easily monitored via manual scoring, but can be accommodated through the computerized WIC ENTER program. Expansion of the nutrient data base to accommodate any desired nutrient is possible. Additional questions could be posed on the FFQ to obtain discreet information on fat or other nutrients in the diet. Such information adds considerably to the personalization of the dietary intake information, aids in nutritional counseling, and is easily coded for entry into a computerized program.

Self-Administered and Computerized Questionnaires

Further investigation of the feasibility of using self-administered, computerized questionnaires as a dietary data collection method in the WIC setting should be considered. The principal advantages of such an approach would be (1) the ability to collect and analyze rather detailed information and produce useful reports in a manner requiring minimal time and effort by the health care provider and (2) the simplification of the data collection process for the client.

Efficient data gathering and reporting. Although evidence of the efficiency of the use of self-administered computerized FFQs has not yet been reported, there are several reasons to believe that computerized FFQs would make it possible for health care providers

to collect data in a comparable or shorter amount of time than usual and to produce useful reports of data analyses in a very short period (e.g., less than 30 seconds, barring difficulties occasionally associated with running computers).

Without the expenditure of an inordinate amount of time, no manual method can produce information comparable to that prepared automatically by the computer. A computer program can tabulate and summarize data on both food and nutrient intake and make comparisons with whatever standards are selected. Once the programming is completed and staff have received the little training required to run the program, the potential for an efficient operation is large.

Simplification of the data collection process for the client. The level of reading and interpretation skills required for completing FFQs increases with the amount of information that is conveyed with a single answer. A response on a form that asks for the frequency of food use represents a complicated thought process involving many elements. If a paper FFQ tries to use branching to break the response down into its elements, the branching process can be quite confusing to the reader.

A computerized, self-administered FFQ can more nearly replicate the process that an interviewer would use. First a simple question is asked, " Did you eat X in the past 4 weeks?" If the answer is "No", the respondent immediately is moved on to other foods. If her answer is "Yes", a second, relatively simple question is asked, such as "How often did you eat X?" followed by a short list of choices. A positive response to one of those choices might trigger another relatively simple question. However, at no time is the woman confronted by a form that is likely to appear complicated, even if well designed.

If the software is designed to be easy to read and use, it appears that low-income women who have basic reading skills can respond to such FFQs quickly and easily [83]. Those women who do not have adequate reading skill can be identified through the brief self-training portion of the program. In contrast, people who cannot read can easily mask this problem when asked to complete most

paper FFQs.

In short, there are serious limitations to the extent that paper FFQs can be simplified and still provide useful information. Computerized questionnaires can circumvent this problem.

ENDNOTES

1. U.S. Department of Agriculture/U.S. Department of Health and Human Services. Dietary Guidelines for Americans. Third edition. Home and Garden Bulletin No. 232, 1990.

2. National Research Council. Recommended Dietary Allowances. Tenth edition. Washington, D.C.: National Academy Press, 1989.

3. Suitor, C.J.W. Nutrition Screening of Low-Income Pregnant Women. Dissertation, Harvard School of Public Health, 1988.

4. Federal Register, Special Supplemental Food Program for Women, Infants and Children (WIC); Review of Nutritional Risk Criteria 55(179):37882-37885, 1990.

5. Federal Register, Special Supplemental Food Program for Women, Infants and Children (WIC); Review of Food Packages 55(206):4256-42860, Oct. 24, 1990.

6. General Accounting Office. Need to Foster Optimal Use of Resources in the Special Supplemental Food Program for Women, Infants and Chilren (WIC), GAO/RCED 85-105, Sept. 27, 1985.

7. The MAXIMA Corporation. Proceedings of the WIC Task Force on Dietary Assessment. July 25-26, 1989, Arlington, Va. Submitted to the U.S. Department of Agriculture, Food and Nutrition Service, Alexandria, Va. undated.

8. Stefanik, P.A., and Trulson, M.F. Determining the frequency intakes of food in large group studies. *American Journal of Clinical Nutrition* 11:335, 1962.

9. Abramson, J.H.; Slome, C.; and Kosovsky, C. Food frequency interview as an epidemiological tool. *American Journal of Public Health* 53:1093, 1963.

10. Cellier, K.M., and Hankin, M.E. Studies of nutrition in pregnancy. I. Some considerations in collecting dietary information. *American Journal of Clinical Nutrition* 13:55, 1963.

11. Hankin, J.H., and Huenemann, R. A short dietary method for epidemiologic studies. I. Developing standards for interpreting seven-day measured food records. *Journal of American Dietetic Association* 50:487, 1967.

12. Hankin, J.H.; Reynolds, W.E.; and Margen, S. A short dietary method epidemiologic studies. II. Variability of measured nutrient intakes. *American Journal of Clinical Nutrition* 20;935, 1967.

13. Hankin, J.H.; Stallones, R.A.; and Messinger, H.B. A short dietary method for epidemiological studies. III. Development of a questionnaire. *American Journal of Epidemiology* 87:285, 1968.

14. Balogh, M.; Medalie, J.H.; Smith H.; and Groen J.J. The development of a dietary questionnaire for an ischemic heart disease survey. *Israel Journal of Medical Sciences* 4:195, 1968.

15. Axelson, J.M., and Csernus, M.M. Reliability and validity of a food frequency checklist. *Journal of American Dietetic Association* 83:152, 1983.

16. Richard, L., and Roberge, A.G. Validity of a short method based on food frequency and multiple regression to evaluate the nutrient intakes of French Canadian women. *Nutrition Research* 6:17, 1986.

17. Chu, S.Y.; Kolonel, L.N.; Hankin, J.H.; and Lee J. A comparison of frequency and quantitative dietary methods for epidemiologic studies in diet and disease. *American Journal of Epidemiology* 119:323, 1984.

18. Block, G.; Hartman, A.M.; Dresser, C.M.; Carroll, M.D.; Gannon, J.; and Gardner, L. A data-based approach to diet questionnaire design and testing. *American Journal of Epidemiology* 124:453, 1986.

19. Willett, W.C.; Sampson, L.; Stamfer, M.J.; Rosner, B., Bain, C.; Witschi, J.; Hennekens, C.H.; and Speizer, F.E. Reproducibility and validity of a semiquantitative food frequency questionnaire. *American Journal of Epidemiology* 122:51, 1985.

20. McKeown-Eyssen, G.E.; Yeung, K.S.; and Bright-See, E. Assessment of past diet in epidemiologic studies. *American Journal of Epidemiology* 124:94, 1986.

21. Mullen, B.J.; Krantzler, N.J.; Grivetti, L.E.; Schutz, H.G.; and Meiselman, H.L. Validity of a food frequency questionnaire for the determination of individual food intake. *American Journal of Clinical Nutrition* 39:136, 1984.

22. Baranowski, T.; Dworkin, R.; Henske, J.C.; Clearman, D.; Dunn, J.K.; Nader, P.R.; and Hooks, P.C. The accuracy of children's self reports of diet: Family Health Project. *Journal of American Dietetic Association* 86:1381, 1986.

23. Williams, A.C.; and Penfield, M.P. Development and validation of an instrument characterizing food-related behavior. *Journal of American Dietetic Association* 85:685, 1985.

24. Caster, W.O. Systematic estimation of food intakes from food frequency data. *Nutrition Research* 6:469, 1986.

25. Samet, J.M.; Humble, C.G.; and Skipper, B.E. Alternatives in the collection and analysis of food frequency interview data. *American Journal of Epidemiology* 120:572, 1984.

26. Hankin, J.H. A diet history method for research, clinical, and community use. *Journal of American Dietetic Association* 86:868,1986.

27. Horwath, C.C.; and Worsley, A. Assessment of the validity of a food frequency questionnaire as a measure of food use by comparison with direct observation of domestic food stores. *American Journal of Epidemiology* 131:1059, 1990.

28. Salvini, S.; Hunter, D.J.; Sampson, L.; Stampfer, M.J.; Colditz, G.A.; Rosner, B.; and Willett, W.C. Food-based validation of a dietary questionnaire: the effects of week-to-week variation in food comsumption. *International Journal of Epidemiology* 18:858,1989.

29. Medlin, C.; and Skinner, J.D. Individual dietary intake methodology: A 50-year review of progress. *Journal of American Dietetic Association* 88:1250, 1988.

30. Sampson, L. Food frequency questionnaires as a research instrument. *Clinical Nutrition* 4:171, 1985.

31. Willett, W.C.; Reynolds, R.D.; Cottrell-Hoehner, S.; Sampson, L.; and Browne, M.L. Validation of a semi-quantitative food frequency questionnaire: Comparison with a 1-year record. *Journal of American Dietetic Association* 87:43, 1987.

32. Krall, E.A.; and Dwyer, J.T. Validity of a food frequency questionnaire a food diary in a short-term recall situation. *Journal of American Dietetic Association* 87:1374, 1987.

33. Hislop, T.G.; Lamb, C.W.; Ng VT. Differential misclassification bias and dietary recall for the distant past using the food frequency questionnaire. *Nutrition Cancer* 13:223, 1990.

34. Potosky, A.L.; Block, G.; and Hartman, A.M. The apparent validity of diet questionnaires is influenced by numbers of diet-record days used for comparison. *Journal of American Dietetic Association* 90:810, 1990.

35. Block, G.; Woods, M.; Potosky, A.; and Clifford, C. Validation of a self-administered diet history questionnaire using multiple diet records. *Journal of Clinical Epidemiology* 43:1327, 1990.

36. Block, G.; and Hartman, A.M. Issues in reproducibility and validity of dietary studies. *American Journal of Clinical Nutrition* 50(Supp):1133, 1989.

37. Kristal, A.R.; Shattuck, A.L.; Henry, H.J.; and Fowler, A.S. Rapid assessment of dietary intake of fat, fiber and saturated fat.Validity of an instrument suitable for community intervention, research and nutritional surveillance. *American Journal of Health Promotion* 4:288, 1990.

38. Suitor, C.W.; and Gardner, J.D. Supplement use among a culturally diverse group of low-income pregnant women. *Journal of American Dietetic Association* 90:268, 1990.

39. Suitor, C.W.; Gardner, J.D.; and Feldstein, M.L. Characteristics of diet among a culturally diverse group of low-income pregnant women. *Journal of American Dietetic Association* 90:543, 1990.

40. Pao, E.M.; Fleming, K.H.; Guenther, P.M.; and Mickle, S.J. Foods Commonly Eaten By Individuals: Amount per Day and per Eating Occasion. USDA HINS Home Economics Research Report No. 44, 1982.

41. Krebs-Smith, S.M.; and Smiciklas-Wright, H. Typical serving sizes: Implications for food guidance. *Journal of American Dietetic Association* 85:1139, 1985.

42. Hunter, D.M.; Sampson, L.; Colditz, G.A.; Rosner, B.; and Willett, W.C. Variability in portion size of commonly consumed foods among a population of women in the United States. *American Journal of Epidemiology* 127:1240, 1988.

43. Clapp, J.A.; McPherson, R.S.; Reed, D.R.; and Bartholomew, P.H. Comparison of a food frequency questionnaire using reported vs standard portion sizes for classifying individuals according to nutrient intake. *Journal of American Dietetic Association* 91:316, 1991.

44. Guthrie, H.A. Selection and quantification of typical food portions by young adults. *Journal of American Dietetic Association* 84:1440, 1984.

45. Webb, C.A.; and Yuhas, J.A. Ability of WIC clientele to estimate food quantities. *Journal of American Dietetic Association* 88:601,1988.

46. Knuiman, J.T.; Rasanen, L.; Ahola, M.; West, C.E.; and van der Snoek. L. The relative validity of reports of food intake of Dutch and Finnish boys aged 8 and 9 years. *Journal of American Dietetic Association* 87:303, 1987.

47. Lewis, C.J.; Beloian, A.M.; and Yetley, E.A. Serving size issues in estimating dietary exposure to food substances. *Journal of American Dietetic Association* 88:1545, 1988.

48. Morgan, J. The dietary survey and the assessment of food intake in the pre-school child. A review. *Journal of Human Nutrition* 34:376, 1980.

49. Emmons, L.; and Hayes, M. Accuracy of 24-hour recalls of young Children. *Journal of American Dietetic Association* 62:409, 1973.

50. Frank, G.C.; Berenson, G.C.; Schillig, P.E.; Moore, M.C. Adapting the 24-hr recall for epidemiologic studies of school children. *Journal of American Dietetic Association* 71:26, 1977.

51. Rasanen, L. Nutrition survey of Finnish rural children. VI. Methodological study comparing the 24-hour recall and the dietary history interview. *American Journal of Clinical Nutrition* 32:2560, 1979.

52. Carter, R.L.; Sharbaugh, C.O.; and Stapell, C.A. Reliabilitay and validity of the 24-hour recall. *Journal of American Dietetic Association* 79:542, 1981.

53. Barankowski, T.; Dworkin, R., Henske, J.C.; Clearman, D.R.; Dunn, J.K.; Nader, P.R.; and Hooks, P.C. The accuracy of children's self reports of diet: Family Health Project. *Journal of American Dietetic Association* 86:1381, 1986.

54. Sanjur, D.; Garcia, A.; Aguilar, R. Furumoto, R.; and Mort, M. Dietary patterns and nutrient intakes of toddlers from low-income families in Denver, Colorado. *Journal of American Dietetic Association* 90:823, 1990.

55. Leung, M.; Yeung, D.L.; Pennell, M.D.; and Hall, J. Dietary intakes of preschoolers. *Journal of American Dietetic Association* 84:551, 1984.

56. Eck, L.H.; Klesges, R.C.; and Hanson, C.L. Recall of a child's intake from one meal: Are parents aaccurate? *Journal of American Dietetic Association* 89:784, 1989.

57. Trieber, F.A.; Leonard, S.B.; Frank, G.; Muscante, L.; Davis, H.; Strong, W.B.; and Levy, M. Dietary assessments for preschool children: Reliability of parental responses to the 24-our recall and a food frequency questionnaire. *Journal of American Dietetic Association* 90:814, 1990.

58. Klesges, R.C.; Klesges, L.M.; Brown, G.; and Frank, G.C. Validation of the 24-hour dietary recall in preschool children. *Journal of American Dietetic Association* 87:1383, 1987.

59. Basch, C.E.; Shea, S.; Arliss, R.; Contendo, I.R.; Rips, J. Gutin, B.; Irigoyen, M.; and Zybert, P. Validation of mother's reports of dietary intake by four to seven year-old children. *American Journal of Public Health* 81:1314, 1990.

60. Eck, L.H.; Klesges, R.C.; Hanson, C.L.; and White J. Reporting retrospective dietary intake by food frequency questionnaire in a pediatric population. *Journal of American Dietetic Association* 91:606, 1991.

61. Guthrie, H.A; and Scheer, J.C. Validity of a dietary score for assessing nutrient adequacy. *Journal of American Dietetic Association* 78:240, 1981.

62. Kennedy, E. A prenatal screening system for use in a community-based setting. *Journal of American Dietetic Association* 86:1372, 1986.

63. Murphy, S.P.; Castillo, R.O.; Martorell, R.; and Mendoza, F. An evaluation of food group intakes by Mexican-American children. *Journal of American Dietetic Association* 90:388, 1990.

64. Strohmeyer, S.L.; Massey, L.K.; and Davison, M.A. A rapid dietary screening device for clinics. *Journal of American Dietetic Association* 84:428, 1984.

65. Scrimger, K.B. Lansing, Mich.: Guidelines for Designing a Food Frequency Questionnaire for the Low Literacy Population. Bureau of Community Services, Michigan Department of Public Health, 1990.

66. Krebs-Smith, S.M.; and Clark, L.D. Validation of a nutrient adequacy score for use with women and children. *Journal of American Dietetic Association* 89:775, 1989.

67. Patterson, B.H.; Block, G.; Rosenberger, W.F.; Pee, D.; and Kahle, L.L. Fruit and Vegetables in the American Diet: Data from the NHANES II Survey, *American Journal of Public Health* 80:1443, 1990.

68. Kant, A.K.; Block, G.; Schatzkin, A.; and Ziegler, R.G. Dietary diversity in the U.S. population, NHANES II, 1976-80, in press.

69. Patterson, B.H; and Block, G. Food choices and the cancer guidelines. *American Journal of Public Health* 78:282-286, 1988.

70. Pao, E.M.; Fleming, K.H.; Guenther, P.M.; and Mickle, S.J. Foods Commonly Eaten by Individuals. Human Nutrition Information Service, Home Economics Research Report No. 44. Washington, D.C.: U.S. Department of Agriculture, 1982.

71. Suitor, C.J.W.; Gardner, J.D.; and Willett, W.C.. A comparison of food frequency and diet recall methods in studies of nutrient intake of low-income pregnant women. *Journal of American Dietetic Association* 89:1786, 1989.

72. Willett, W., Harvard School of Public Health, private communication, 1988.

73. Block, G. National Cancer Institute. Health Habits and History Questionnaire: Diet History and Other Risk Factors. Personal Computer System Packet. National Institutes of Health. Bethesda, Md. 1987.

74. U.S. Department of Agriculture, Nutrition Monitoring Division. Nationwide Food Consuption Survey, Continuing Survey of Food Intakes by Individuals. Women 19-50 Years and Their Children 1-5 Years, 1 Day. Washington, D.C., (CSFII Report No. 85-1), 1985.

75. PC SAS Release 6.04

76. Willett, W.C. Nutritional Epidemiology. Oxford University Press, Cambridge, 1990.

77. Suitor, C.W.; and Gardner, J. Unpublished manuscript.

78. Smith, A.F.; Jobe, J.B.; and Mingay, D.J. Question-induced cognitive biases in reports of dietary intake. *Health Psychology* (in press).

79. Smith, A.F.; Jobe, J.B.; and Mingay, D.J. Retrieval from memory of dietary information. *Applied Cognitive Psychology* (in press).

80. Smith, A.F. Cognitive processes in long-term dietary recall. *Vital and Health Statistics* (in press).

81. Splett, P.L. Child Nutrition: Objectives for the decade. *Journal of American Dietetic Association* 91: 665, 1991.

82. The Surgeon General's Report on Nutrition and Health. Washington D.C.: U.S. Dept. of Health and Human Services, Public Health Service; 1988. DHHS Pub. PHS 88-50210.

83. Suitor, C.W.; and Gardner, J. Development of an Interactive, Self-Administered Computerized Food Frequency Questionnaire for Use with Low-Income Women. *Journal of Nutrition Education* (in press).

APPENDIX A

PRENATAL FOOD FREQUENCY QUESTIONNAIRE (PFFQ) USED IN THE VALIDATION STUDY

ID_____

DATE___/___/____

WHAT HAVE YOU BEEN EATING LATELY?

DURING THE PAST 4 WEEKS, HOW OFTEN ON AVERAGE DID YOU EAT A SERVING OF EACH OF THE FOODS LISTED HERE?

PLEASE MARK ONLY ONE X FOR EACH FOOD	Never	per month	per week			per day				
		1 - 3	1	2 - 4	5 - 6	1	2 - 3	4 - 5	6+	
Milk, any kind										1
Ice cream or ice milk										2
Yogurt, plain or flavored										3
Cheese, plain, or in sandwiches or casseroles										4
Cottage cheese or ricotta										5
Pudding or custard										6
Fresh orange, grapefruit, or tangerine										7
Orange or grapefruit juice										8
Apple or pineapple juice or cider										9
Tomato juice or vegetable (V-8) juice										10
Bananas										11
Grapes										12
Peaches, apricots, or nectarines										13
Melon (such as canteloupe, watermelon)										14
Strawberries										15
Apples										16
Papaya or mangoes										17
Pineapple										18
Raisins, prunes or other dried fruit										19
Broccoli or asparagus										20
Cabbage, coleslaw, or cauliflower										21
Carrots										22
Corn										23
Lettuce, as in tossed salad										24
Green or wax beans										25
Spinach										26
Other Greens like collard or turnip greens or kale										27
Orange (winter) squash										28
Peas, lima beans, mixed vegetables										29

C.J.W.Suitor: 8/86

PLEASE TURN TO NEXT PAGE

PLEASE MARK ONLY ONE X FOR EACH FOOD	HOW OFTEN ON AVERAGE DURING THE LAST 4 WEEKS?									
	Never	per month 1 - 3	per week 1	per week 2 - 4	per week 5 - 6	per day 1	per day 2 - 3	per day 4 - 5	per day 6+	
Peppers (green, red, chili)										30
Plantains										31
Green bananas										32
Tomatoes										33
Tomato sauce (e.g., Spaghetti sauce)										34
Baked beans or chili beans										35
Cooked dried beans or lentils, as in rice and beans)										36
Peanut butter or peanuts										37
Other nuts										38
Hotdogs										39
Liver										40
Ham										41
Bologna, other cold cuts										42
Hamburger, plain or in mixtures										43
Chicken or turkey										44
Roast beef or steak										45
Pork										46
Bacon										47
Sausage										48
Tunafish										49
Other kinds of fish or shellfish										50
Cake										51
Sweet roll, coffee cake or Danish										52
Donut										53
Pumpkin, squash or sweet potato pie										54
Other kinds of pie										55
Gelatin dessert or sherbet										56
Jelly, jam or syrup										57
Cookies or brownies										58
Chocolate candy										59
Candy without chocolate										60
White bread - plain, as toast, and in sandwiches										61
Dark bread (1 slice)										62

PLEASE TURN TO NEXT PAGE

HOW OFTEN ON AVERAGE DURING THE LAST 4 WEEKS?

PLEASE MARK ONLY ONE X FOR EACH FOOD	Never	per month 1 - 3	per week 1	per week 2 - 4	per week 5 - 6	per day 1	per day 2 - 3	per day 4 - 5	per day 6+	
Cold breakfast cereal (1 bowl)										63
Cooked cereal (1 bowl)										64
English muffins, bagels, or rolls (1)										65
Muffins or biscuits (1)										66
Pancakes, waffles, or French Toast (1 serving)										67
Rice (one serving)										68
Pasta - spaghetti, noodles, macaroni (1 serving)										69
Cornbread or tortillas (1 piece)										70
French fried potatoes (1 serving)										71
Potatoes, baked, boiled or mashed										72
Yams or sweet potatoes (1 serving)										73
Potato or corn chips (1 small bag)										74
Crackers, Triskets, Wheat Thins										75
Pizza (2 slices)										76
Tomato, vegetable, or minestrone soup										77
Cream soup or chowder made with milk										78
All other kinds of soup										79
Coffee, decaffeinated coffee, or tea										80
Cream, any kind										81
Regular soft drinks like Coke or Pepsi										82
Diet Pepsi, Diet Coke or other diet cola										83
Fruit drinks such as Hi-C, lemonade										84
Powdered drink mixes (Kool-Aid)										85
Beer, wine, or liquor										86
Butter or margarine										87
Mayonnaise or salad dressing										88

How many eggs do you usually eat each week? ____ **eggs per week** 89

PLEASE PUT AN X IN THE SPACE THAT TELLS HOW OFTEN YOU TOOK EACH TYPE OF PILL DURING THE PAST 4 WEEKS. MARK NEVER IF YOU DON'T TAKE THEM.

Prenatal vitamins

Never____ 1-3 times/week____ 4-6 times/week____ Every day____ Twice a day____ 3 times a day____

Iron pills

Never____ 1-3 times/week____ 4-6 times/week____ Every day____ Twice a day____ 3 times a day____

Do you take any other vitamin or mineral pills? No____ Yes____ What type? _____

C.J.W.Suitor: 7/86

PLEASE TURN TO NEXT PAGE

If you take vitamin pills or iron, how often do you forget to take a pill? 93

Never____ 1-3 times/week_____ 4-6 times a week_____ Every day_____

During pregnancy, many women change the amount of food they eat from month to month. Has your intake changed during the past 4 weeks for any of these foods?

FOOD OR BEVERAGE	No Change	More Now	Less Now	
Milk and cheese				94
Fruit, juice, and vegetables				95
Grains (bread, cereal, rice, pasta, etc.)				96
Main dishes (meat, fish, poultry, combination dishes)				97
Sweets, desserts				98

Did you take vitamin pills or minerals before you knew you were pregnant? Yes____ No____

If you did, what kind were they?_____

How is your appetite? Good_____ Fair_____ Poor_____

What kind of cold breakfast cereal do you most often use? (Name exact type))_____

How many teaspoons of sugar do you add to your food daily (include for coffee, tea, cereal, etc) _____

How often do you eat a sandwich, burger, or sub?

Never_____ 1-3 /week_____ 4-6 /week_____ 1/day_____ More than 1/day_____

If you drink juice, how much do you usually have? (Check only one)

Small juice glass _____ OR Carton, can, or bottle from vending machine, or large glass _____

What kind of milk do you usually drink? None_____ Regular_____ 2%_____ Skim_____

Chocolate_____ Buttermilk_____

If you drink milk, how much do you usually have? (Check only one)

Small (juice) glass_____ OR Medium glass or small (8 oz) carton_____ OR Large (12 oz) glass_____

When you have meat, fish or poultry as a main dish, how much do you usually have? (Check only one)

Small _____ Medium _____ Large _____

How often did you have any of these discomforts of pregnancy in the past two weeks?

Nausea (morning sickness) Never_____ 1-3 times_____ 4-7 times_____ More than 7 times_____

Vomiting Never_____ 1-3 times_____ 4-7 times_____ More than 7 times_____ 109

Heartburn Never_____ 1-3 times_____ 4-7 times_____ More than 7 times_____ 110

Constipation Never_____ 1-3 times_____ 4-7 times_____ More than 7 times_____ 111

THANK YOU VERY MUCH FOR COMPLETING THIS FORM!

APPENDIX B

WFFQ AND CFFQ WITH RECOMMENDED VERBAL INSTRUCTION FOR ADMINISTERING THE QUESTIONNAIRES

Women's Nutrition Questionnaire

What Have You Been Eating Lately ?

During the past 4 weeks, how often did you eat a serving of each of the foods listed here?
Mark only one X for each food

Name _____
ID _____
Date _____
DOB _____
Pregnant [ ]
EDC _____
Breastfeeding 1st 6 months [ ]
Breastfeeding 2nd 6 months [ ]
Not Breastfeeding [ ]

	last 4 wks		each week			each day				
Number of times	0	1-3	1	2-4	5-6	1	2-3	4-5	6+	
Milk										1
Hot chocolate										2
Cheese, plain or in sandwiches										3
Yogurt										4
Ice cream										5
Pudding										6

What kind of milk do you drink?
whole [ ] lowfat [ ] skim [ ]

	last 4 wks		each week			each day				
Number of times	0	1-3	1	2-4	5-6	1	2-3	4-5	6+	
Orange or grapefruit										7
Orange juice or grapefruit juice										8
Apple juice										9
Other fruit drinks (Hi-C, Kool-aid, grape)										10
Banana										11
Apple or applesauce										12
Grapes										13
Peaches										14
Strawberries										15
Cantaloupe										16
Watermelon										17
Pineapple										18
Raisins or prunes										19

Mark only one X for each food

How often did you eat a serving of these foods during the past 4 weeks?

	last 4 wks		each week			each day				
Number of times	0	1-3	1	2-4	5-6	1	2-3	4-5	6+	
Corn										20
Peas (canned, frozen, or fresh)										21
Tomatoes										22
Peppers (green, red, hot)										23
Carrots										24
Broccoli										25
Green beans										26
Spinach										27
Greens (mustard, turnip, collards)										28
Squash, orange or winter										29
French fries, fried potatoes										30
Potatoes (baked, boiled, or mashed)										31
Sweet potatoes or yams										32
Cabbage or coleslaw										33
Lettuce salad										34
Salad dressing or mayonnaise										35

	last 4 wks		each week			each day				
Number of times	0	1-3	1	2-4	5-6	1	2-3	4-5	6+	
Chips (potato, corn, others)										36
Nuts										37
Cookies or brownies										38
Cake or cupcake										39
Pie (pumpkin, sweet potato, or squash)										40
Other pie										41
Jello										42
Chocolate candy										43
Other candy										44
Coffee or tea										45
Soft drinks										46
Sugar-free soft drinks										47

Mark only one X for each food

How often did you eat a serving of these foods during the past 4 weeks?

	last 4 wks		each week			each day				
Number of times	0	1-3	1	2-4	5-6	1	2-3	4-5	6+	
Baked beans or chili beans										48
Other dried beans, peas, or Lima beans										49
Rice										50
Spaghetti or other pasta with sauce										51
Pizza										52
Macaroni and cheese										53
Hot dogs										54
Hamburgers, meatballs, or meatloaf										55
Canned tuna										56
Cold cuts (baloney, ham, salami)										57
Peanut butter										58
Bread, toast, or rolls										59
Margarine or butter										60
Chicken or turkey										61
Pork chops, roast pork, or ribs										62
Steak or roast beef										63
Fish										64
Liver										65
Sausage										66
Bacon										67
Hot cereal or grits										68
Cold breakfast cereal										69
Donut										70
Sweet roll or muffin										71
Pancake, waffle, or French toast										72
English muffin or bagel										73
Biscuit										74
Cornbread or tortillas										75
Vegetable soup										76
Other soup										77
Crackers										78

How many eggs do you eat in one week?_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ ○

Children's Nutrition Questionnaire

Name _____
ID _____
Date _____
DOB _____
Age _____
Respondent
Mother [ ]
Other [ ] _____

What Has Your Child Been Eating Lately?

During the past 4 weeks, how often did your child eat a serving of each of the foods listed here?
Mark only one X for each food

	last 4 wks		each week			each day				
Number of times	0	1-3	1	2-4	5-6	1	2-3	4-5	6+	
Milk										1
Hot chocolate										2
Cheese, plain or in sandwiches										3
Yogurt										4
Ice cream										5
Pudding										6

What kind of milk do you drink?
whole [ ] lowfat [ ] skim [ ]

	last 4 wks		each week			each day				
Number of times	0	1-3	1	2-4	5-6	1	2-3	4-5	6+	
Orange										7
Orange juice										8
Apple juice										9
Other fruit drinks (Hi-C, Kool-aid, grape)										10
Banana										11
Apple or applesauce										12
Grapes										13
Peaches										14
Strawberries										15
Cantaloupe										16
Watermelon										17
Pineapple										18
Raisins										19

Mark only one X for each food

How often did your child eat a serving of these foods during the past 4 weeks?

	last 4 wks		each week			each day				
Number of times	0	1-3	1	2-4	5-6	1	2-3	4-5	6+	
Corn										20
Peas (canned, frozen, or fresh)										21
Tomatoes										22
Peppers (green, red, hot)										23
Carrots										24
Broccoli										25
Green beans										26
Spinach										27
Greens (mustard, turnip, collards)										28
Squash, orange or winter										29
French fries, fried potatoes										30
Potatoes (baked, boiled, or mashed)										31
Sweet potatoes or yams										32
Cabbage or coleslaw										33
Lettuce salad										34
Salad dressing or mayonnaise										35

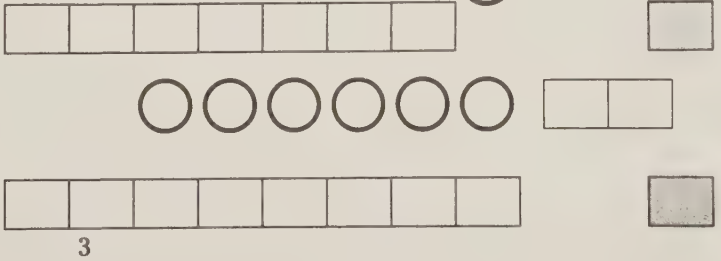
	last 4 wks		each week			each day				
Number of times	0	1-3	1	2-4	5-6	1	2-3	4-5	6+	
Chips (potato, corn, others)										36
Nuts										37
Cookies or brownies										38
Cake or cupcake										39
Pie (pumpkin, sweet potato, or squash)										40
Other pie										41
Jello										42
Chocolate candy										43
Other candy										44
Tea										45
Soft drinks										46
Sugar-free soft drinks										47

Mark only one X for each food

How often did your child eat a serving of these foods during the past 4 weeks?

	last 4 wks		each week			each day				
Number of times	0	1-3	1	2-4	5-6	1	2-3	4-5	6+	
Baked beans or chili beans										48
Other dried beans, peas, or Lima beans										49
Rice										50
Spaghetti or other pasta with sauce										51
Pizza										52
Macaroni and cheese										53
Hot dogs										54
Hamburgers, meatballs, or meatloaf										55
Canned tuna										56
Cold cuts (baloney, ham, salami)										57
Peanut butter										58
Bread, toast, or rolls										59
Margarine or butter										60
Chicken or turkey										61
Pork chops, roast pork, or ribs										62
Steak or roast beef										63
Fish										64
Liver										65
Sausage										66
Bacon										67
Hot cereal or grits										68
Cold breakfast cereal										69
Donut										70
Sweet roll or muffin										71
Pancake, waffle, or French toast										72
English muffin or bagel										73
Biscuit										74
Cornbread or tortillas										75
Vegetable soup										76
Other soup										77
Crackers										78

How many eggs does your child eat in one week? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ ○



Recommended Verbal Instruction for Administering the Women's and Children's Food Frequency Questionnaires

1. Fill in the client identification information in the upper right-hand corner.

2. Provide the appropriate questionnaire, clipboard, and pen. Say to the woman: "This is the form we would like you to fill out. It has three sides. We want you to think about what you ate (or your child ate) during the last four weeks. We know you can't remember exactly, but you probably have a good idea.

   "Suppose you (or your child) drank one glass of milk [point to milk] everyday [point to per day]. Then you put an X or a check here [point]. These columns are for foods you had just once, twice or three times in the last four weeks [point]."

   "We are asking about serving of food, not tastes. So if you put an X here [point to ice cream, 6+/day], that would say that you had eaten six or more bowls of ice cream every day for the past four weeks. Use this column only for foods you ate a lot of every day. Please make a mark in this column [never] if you did not eat the food. It helps you to keep your place and it helps us to know that you did not forget a food."

3. Watch as the client fills out the first 3 foods to be sure she understands the instructions.

4. Collect the finished form and check for errors in completion,
   i.e., pages or rows not filled in, double marked rows,
   number of eggs.

APPENDIX C

GENERAL INSTRUCTION AND TEMPLATES FOR MANUALLY SCORING THE WFFQ AND CFFQ

(Note: Actual templates heavy paperstock, plastic coated, color coded and the spaces within the dotted lines cut out)

General Instructions for Manual Scoring WFFQ and CFFQ

1. Quickly look at the three pages of the questionnaire to assess completeness and accuracy in filling out the questionnaire.

   - Are there **many checks** (e.g., more that 6) **in the two columns on the far right** (those for 4 or more times daily)? If yes, assume that the woman had difficulty understanding how to complete the form. Evidence suggests that such women may be at high risk of inadequate dietary intake.

   - Are there **many checks in the two columns on the far left** (those for never or up to three times per month)? If all but 6 to 8 marks are in those two columns, either the woman had difficulty understanding how to complete the form, or the marks are accurately reflecting inadequate dietary intake.

   - Are there rows in which no check appears or in which more than one check appears? If yes, delay scoring until the woman can clarify the correct response (if possible). Alternatively, follow these rules if no more than 6 rows are mismarked:

     - a **doubly-marked row followed by a correctly-marked row**, count the first check only.

     - a **doubly-marked row followed by a blank row**, transfer the second check (the one on the right) down to the blank row.

     - a **blank row followed by a doubly-marked row**, transfer the first check (the one on the left) up to the blank row.

     - a **blank row preceded and followed by correctly-marked rows**, mark 0 under "Never" (the far left-hand column).

     If greater than 6 rows are mismarked the women had difficulty filling out the questionnaire.

   - Score the food groups in order, beginning with <u>Milk Products</u> (Template 1). Carefully follow the directions on Template 1. When comparing the numbers in the colored boxes on the template with those on the questionnaire, look at the numbers from right to left (that is, compare the right-most number first). If the WIC criteria for eligibility have been met based on unmet minimum servings in one or both of these food groups, it is efficient to discontinue the scoring and begin nutrition counseling or education using the information provided by the questionnaire.

   - To continue scoring,1 place Template 2 on page 2 and score the <u>Vegetables</u>

group, following the directions on the template. If criteria for eligibility have been met based on the first three food groups, consider moving directly to nutrition education or counseling using the information about foods provided by the questionnaire.

- To continue scoring, place Template 3 on page 3 and score the Meats group, following the directions on the template.

- To continue scoring, place Template 4 on page 3 and score the Grains group, following the directions on the template. Recognize that this group poses special problems in estimating the number of portions. For many foods (e.g., roll, spaghetti with sauce), a frequency of 1/day may actually represent 2 to 3 "standard" portion sizes per day.

BACKGROUND INFORMATION
RELATIONSHIPS OF FOOD GROUPS AND NUTRIENT ADEQUACY

For most nutrients, choosing the recommended number of servings from the food groups does not guarantee that intake will match some target level of intake, such as the Recommended Dietary Allowances (RDA) or 75% of the RDA.

The tables given below give an idea of the range of intake of selected nutrients that may be achieved by combinations of commonly consumed foods. These estimates are calculated using the nutrient content for median portion sizes for women as determined in NHANES-II, with a few exceptions.

Calcium

From American cheese twice/day: 174 x 2 = 348 mg calcium
From milk twice/day: = 322 x 2 = 644 mg calcium
From cheese 1/day and yogurt 1/day = 301 + 174 = 475 mg calcium

Daily foods contribute from 55 to 72 percent of calcium in the diet.

Vitamin C Intake

To identify pregnant and lactating women who are unlikely to consume adequate amounts of vitamin C[1], ask these questions:

o Were oranges or orange juice used at least 5x/wk? (If yes, vitamin C intake will be 45 to 60 mg/day from the citrus fruit alone; additional intake of most other fruits and vegetables will increase vitamin C intake by at least 6 mg/serving.

o If no, was melon (cantaloupe or watermelon) or broccoli eaten at least 1/day? (If yes, vitamin C intake will be approximately 40 to 55 mg/day from these foods.

If no, ask:

o Is there a [-] in both the fruit and the vegetable groups?

If no, vitamin C intake was probably at least 35 mg daily and often will be much higher.

If yes (if there is a [-] in both groups, vitamin C intake from fruits and vegetables may be below 35 mg/day.

---

[1] This refers to vitamin C intake from nonfortified foods. Because of the widespread practice of fortifying fruit drinks and fruit-flavored drinks with vitamin C and because of the widespread consumption of these products, intake of vitamin C tends to be relatively high.

Vitamin A Intake

To identify pregnant women who are unlikely to consume adequate amounts of vitamin A, ask these questions:

- o Is there an [X] for the milk group?
- o Was margarine or butter used at least 2x/day?
- o Were at least 4 eggs eaten per week?

If the answer is "Yes" to all the above questions, assume that one-half of the RDA for vitamin A has been provided by these foods. The balance of the RDA could be provided by many food choices, for example:

- carrots 2x/week
- carrots, melon, spinach, and sweet potatoes each once/week
- a daily serving of melon, spinach or other greens, sweet potatoes, or winter squash
- a daily serving of salad, peas or green beans, and broccoli or tomatoes.

(See attached table that gives the vitamin A content of foods (in decreasing order) for median portion sizes for women.

If the answer is "No" to all the questions about dairy products and eggs, reaching the RDA for vitamin A may pose a greater challenge, for example:

- carrots at least 3x/week (~730 RE/day) or
- liver at least 2/month (654 RE/day) or
- 10 servings/week (one to two servings/day) of vitamin A-rich vegetables (other than carrots), choosing from spinach, other greens, winter squash, sweet potatoes, cantaloup, or a food made with carrots (such as vegetable soup or stew).[2] (~700 RE/day)

- Note: if liver was eaten at least 1/month, vitamin A intake averaged a minimum of approximately 350 RE/day.

---

[2] Note that broccoli, tomatoes, and peaches are relatively low in vitamin A value and that low fat or skim milk dairy products, such as many yogurts and hot chocolate made from a mix, are not ordinarily fortified like skim milk is and therefore are low in vitamin A.

POTENTIALLY IMPORTANT NUTRIENT SOURCES FOR FAMILIES OF SELECTED ETHNIC BACKGROUNDS

Those of Carribean Background

Vitamin A: papayas, mangos
Vitamin C: papayas

Fruits: avocados, papayas, mangos
Vegetables: plantains, green bananas, yautia

Those of Mexican-American Background

Vitamin A: cilantro
Vitamin C: chili peppers, salsa

Fruit: pricklypear
Vegetables: cactus (in desert regions), cilantro, salsa

Milk: sweetened condensed

American Indians (varies greatly with the Indian Nation)

Fruit: Ask about wild fruits in season, such as berries
Vegetables: Ask about wild vegetables in season, such as fiddle heads, burdock root
Meat: (Midwestern states) ask about lamb; game meats (such as venison).

Southeast Asian

Vegetables: Ask about bok choy, daikon, eggplant, sprouts, green onions (scallions), bittermelon, snow peas, leeks, bamboo shoots, watercress, waxgourd (Chinese preserving melon)
Fruits: Jackfruit, lychees, longan, mango, papaya
Meats: various organ meats, tofu, duck

Vitamin A: Ask about bok choy, watercress, mangos, papayas
Vitamin C: Ask about papaya, lychees, longan

African American

Vitamin A: Check questionnaire for greens
Vitamin C: Check questionnaire for greens, yams
Meat: various organ meats, including hog maw and chitterlings

Template to Score Women's and Children's Nutrition Questionnaires

Please Follow the Directions in the Order Given

Milk Products and Fruits

1. Place this template on Page 1 so that the two shaded boxes show through the holes in the template.
2. Count the checks in each column, and write the numbers in the boxes beneath each column.
3. Using the colors above the boxes and the numbers in the boxes, compare with the following combinations for a match working from right to left. Once a match is found, mark the shaded box on the questionnaire with the symbol in the gray box (X or -) next to the matched combination.

   In the combinations, any number that crosses two or more small boxes is the TOTAL of those small boxes.
4. Once you have marked the shaded box, go to the next food group.*

Milk Products Combinations

4						-
					≥1	X
				≥2	0	X
			≥2	1	0	X
		≥1	1	1	0	X
	2	0	1	1	0	X
			≥3	0	0	X
No match						-

Fruits Combinations

≥10						-
					≥1	X
			≥2		0	X
		≥4	1		0	X
	≥1	3	1		0	X
	≥3	2	1		0	X
	≥5	1	1		0	X
	≥7	0	1		0	X
		≥7	0		0	X
	≥2	6	0		0	X
	≥4	5	0		0	X
	≥6	4	0		0	X
	8	3	0		0	X
No match						-

* The shaded box with the mark [X] indicates the minimum intake has been met or exceeded.
The shaded box with the mark [-] indicates the minimum intake has not been met.

Vegetables

1. Place this template on Page 2 so that the shaded box shows through the hole in the template.
2. Count the checks in each column, and write the numbers in the boxes beneath each column.
3. Multiply the number in the box under B2 by 2. Add that result to the number in the box under B1, and write the sum in the circle.
4. Using the colors above the boxes, the numbers in the boxes, and the circle, compare with the following combinations for a match working from right to left. Once a match is found, mark the shaded box on the questionnaire with the symbol in the gray box (X or -) next to the matched combination.

   In the combinations, any number that crosses two or more small boxes is the TOTAL of those small boxes.
5. Once you have marked the shaded box go to the next food group.*

Vegetables Combinations

≥5	( )		0	0	-
	( )			≥2	X
	( )		≥1	1	X
	( )		≥3	0	X
	( )	≥2	2	0	X
	(≥2)	1	2	0	X
	(≥7)	0	2	0	X
	( )	≥3	1	0	X
	(≥2)	2	1	0	X
	(≥9)	1	1	0	X
	(≥14)	0	1	0	X
	( )	≥5	0	0	X
	(≥1)	4	0	0	X
	(≥6)	3	0	0	X
	(≥11)	2	0	0	X
	(≥16)	1	0	0	X
	(≥21)	0	0	0	X
No match					-

---

* The shaded box with the mark [X] indicates the minimum intake has been met or exceeded.
The shaded box with the mark [-] indicates the minimum intake has not been met.

Meats

1. Place this template on Page 3 so that the shaded box shows through the hole in the template.

2. Count the checks in each column, and write the numbers in the boxes beneath each column.

3. Make an adjustment for eggs by adding 1 to the number of one box, as shown below:

Number of eggs/wk	Women	Children
1	None	[+1]
2 or 3	[+1]	[+1]
4	[+1]	[+1]
5 or more	[+1]	[+1]

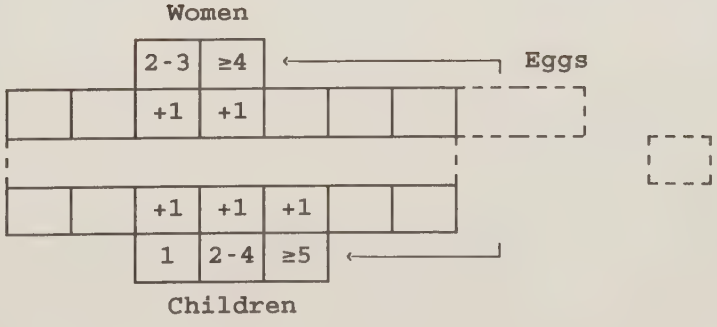
4. Using the colors above the boxes and the numbers in the boxes, compare with the following combinations for a match working from right to left. Once a match is found, mark the shaded box on the questionnaire with the symbol in the gray box (X or -) next to the matched combination.

   In the combinations, any number that crosses two or more small boxes is the TOTAL of those small boxes.

5. Once you have marked the shaded box, go to the next food group.*

Meats Combinations

≥6				0	0	-
					≥1	X
				≥2	0	X
			≥2	1	0	X
		≥1	1	1	0	X
	≥2	0	1	1	0	X
			≥3	0	0	X
		≥2	2	0	0	X
	≥2	1	2	0	0	X
	≥4	0	2	0	0	X
		≥5	1	0	0	X
	≥1	4	1	0	0	X
	≥3	3	1	0	0	X
	≥5	2	1	0	0	X
	7	1	1	0	0	X
		≥7	0	0	0	X
	≥2	6	0	0	0	X
	4	5	0	0	0	X
No match						-



---

* The shaded box with the mark [X] indicates the minimum intake has been met or exceeded.
The shaded box with the mark [-] indicates the minimum intake has not been met.

Grains

1. Place this template on Page 3 so that the shaded box shows through the hole in the template.

2. Count the checks in each column, and write the numbers in the boxes beneath each column.

3. Using the colors above the boxes and the numbers in the boxes, compare with the following combinations for a match working from right to left. Once a match is found, mark the shaded box on the questionnaire with the symbol in the gray box (X or -) next to the matched combination.

   In the combinations, any number that crosses two or more small boxes is the TOTAL of those small boxes.

Grains Combinations 1

≥5				0				-
						≥1		X

4. If you have marked the shaded box, stop.* Otherwise, continue the following steps.

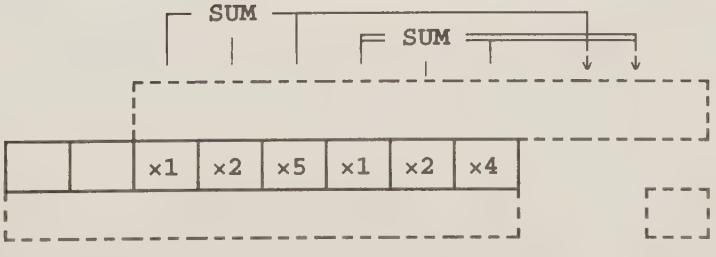
5. Multiply the numbers in the boxes by the numbers shown on the template, and write the results in the circles above the boxes. Add the values in the circles under the yellow, and write the sum in the white box. Add the values in the circles under the green, and write the sum in the box under the blue.

6. Compare the numbers in the white box and the box under the blue with the following combinations for a match working from right to left. Once a match is found, mark the shaded box on the questionnaire with the symbol in the gray box (X or -) next to the matched combination.

7. Once you have marked the gray box, stop.*

Grains Combinations 2

	≥6	X
≥7	5	X
≥14	4	X
≥21	3	X
≥28	2	X
≥35	1	X
≥42	0	X
No match		-



---

* The shaded box with the mark [X] indicates the minimum intake has been met or exceeded.
The shaded box with the mark [-] indicates the minimum intake has not been met.

APPENDIX D

DOCUMENTATION AND TEMPLATES FOR SCORING WFFQ AND CFFQ WITH WIC ENTER

DOCUMENTATION FOR WIC ENTER

INTRODUCTION

The WIC ENTER application software was developed to handle coded responses to Women's Nutrition Questionnaires and Children's Nutrition Questionnaires for children aged 1 through 4 years old. It provides a preliminary individual analysis and saves the coded responses and analysis for each client. There are two sets of programs and data files which are used to deal with Women's Nutrition Questionnaires and Children's Nutrition Questionnaires separately. A DOS batch file is used to provide an easy way to access either of the programs. The programs were written in the C programming language and compiled with the Borland Turbo C* compiler Version 2.0. Data files have the dBASE** dbf format, which is relatively simple and compact, and can be easily read by many MS-DOS applications for further analysis.

ENVIRONMENT

WIC ENTER runs on an IBM PC or compatible computer. There are no particular demands made on memory, display, printer, or disk configuration. The contents of WIC ENTER occupy approximately 170K bytes of disk space and each saved record for a client consumes about 240 bytes, so it can run on the computer with only a low density floppy drive.

CONTENTS OF WIC ENTER

The program and data files of WIC ENTER are contained on a single 3.5-inch or 5.25-inch floppy disk titled WIC ENTER. There are 7 files residing on the diskette. ENTERW.EXE and ENTERW.DBF are the program and data file for Women's Nutrition Questionnaires, and ENTERC.EXE and ENTERC.DBF are the program and data file for Children's Nutrition Questionnaires. WICENTER.BAT, WICENTER.DAT and BE.EXE are the components of the batch file.

BACKUP

Before doing anything else, make a backup copy of the diskette. Using the backup copy not only protects the original copy but also preserves the empty data files for future use.

* Turbo C is a registered trademark of Borland International, Inc.
** dBASE is a registered trademark of Ashton-Tate

INSTALLING WIC ENTER

WIC ENTER can be run on a floppy drive directly or be installed from the floppy disk onto a hard disk. We suggest that you create a directory named WICENTER on the hard disk. If you are going to install it on drive C, for example, and this floppy disk is in drive A, you would first enter

MD C:\WICENTER

And copy the files to the newly created directory by entering:

COPY A:*.* C:\WICENTER

RUNNING WIC ENTER

If you are going to run the application on a floppy drive, insert the diskette in the A (or B) drive. When you see the A> (or B>) prompt, type WICENTER and then hit the [Enter] key to invoke the program. If you have installed the application in the directory named WICENTER on the drive C and are going to run it, you first enter

CD C:\WICENTER

Then type WICENTER and hit the [Enter] key.

The programs for Women's or Children's Nutrition Questionnaires can also be executed separately. Type ENTERW instead of WICENTER to run the program for Women's Nutrition Questionnaires, and type ENTERC to run the program for Children's Nutrition Questionnaires.

MAIN FUNCTIONS OF WIC ENTER

The main functions of WIC ENTER are as follows:

1. Enter data on a client
2. Retrieve data entered before
3. Edit data entered before
4. Display the analysis of data on the screen
5. Print the analysis of data

All entered data are subject to range check and logical error check.

OUTPUT OF THE ANALYSIS

The application employs the 1989 Recommended Dietary Allowances for age and physiologic status and portion sizes based mainly on medians reported by comparable populations in nationwide surveys for analyzing the data from the questionnaires. It generates screen displays and printouts that report the mean servings per day by 9 food groups, the total of selected food items, total estimated calories per day and a bar chart showing the client's indexes of nutritional quality for the nutrients protein; calcium; iron; zinc; and vitamins A, B-6, C, and folate. The printouts also lists the mean servings per week reported for each food item.

The index of nutritional quality (INQ) is computed by the following formula:

$$\frac{\text{Estimated nutrient intake / estimated energy intake}}{\text{RDA for the nutrient / recommended energy intake}} \times 100$$

OUTPUT DATA FILES

Client's ID, the session date, the date of birth, the coded responses from the questionnaires, the calorie total and the nutrients totals per day are recorded. If a client is a women, the physical status and EDC are also recorded. These data are saved in the dBASE dbf format files ENTERW.DBF for women's questionnaires and ENTERC.DBF for children's questionnaires and can be used for further analysis.

Template to Enter Data from Women's and Children's Nutrition Questionnaires to WIC ENTER

last 4 wks		each week			each day			
0	1-3	1	2-4	5-6	1	2-3	4-5	6+
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8

last 4 wks		each week			each day			
0	1-3	1	2-4	5-6	1	2-3	4-5	6+
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8

Use -1 for no check in the row.

Use -2 for more than one check in the row.

Template to Enter Data from Women's and Children's Nutrition Questionnaires to WIC ENTER

last 4 wks		each week			each day			
0	1-3	1	2-4	5-6	1	2-3	4-5	6+
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8

last 4 wks		each week			each day			
0	1-3	1	2-4	5-6	1	2-3	4-5	6+
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8

Use -1 for no check in the row.

Use -2 for more than one check in the row.

Template to Enter Data from Women's and Children's Nutrition Questionnaires to WIC ENTER

last 4 wks		each week			each day			
0	1-3	1	2-4	5-6	1	2-3	4-5	6+
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8

Use -1 for no check in the row.

Use -2 for more than one check in the row.

APPENDIX E

SAME WFFQ SCORED MANUALLY AND WITH WIC ENTER

Women's Nutrition Questionnaire

What Have You Been Eating Lately ?

During the past 4 weeks, how often did you eat a serving of each of the foods listed here?
Mark only one X for each food

Name _____
ID 1B
Date 6/25/91
DOB 6/25/61
Pregnant [X]
EDC 11/19/91
Breastfeeding 1st 6 months [ ]
Breastfeeding 2nd 6 months [ ]
Not Breastfeeding [ ]

	last 4 wks		each week			each day				
Number of times	0	1-3	1	2-4	5-6	1	2-3	4-5	6+	
Milk				X						1
Hot chocolate	X									2
Cheese, plain or in sandwiches				X						3
Yogurt			X							4
Ice cream				X						5
Pudding	X									6

What kind of milk do you drink?
whole [X] lowfat [ ] skim [ ]

1	0	1	2	0	0	0	0	0	—

	last 4 wks		each week			each day				
Number of times	0	1-3	1	2-4	5-6	1	2-3	4-5	6+	
Orange or grapefruit					X					7
Orange juice or grapefruit juice				X						8
Apple juice			X							9
Other fruit drinks (Hi-C, Kool-aid, grape)					X					10
Banana		X								11
Apple or applesauce			X							12
Grapes		X								13
Peaches				X						14
Strawberries			X							15
Cantaloupe			X							16
Watermelon			X							17
Pineapple				X						18
Raisins or prunes	X									19

1	2	5	3	1	0	0	0	0	X

Mark only one X for each food

How often did you eat a serving of these foods during the past 4 weeks?

	last 4 wks		each week			each day				
Number of times	0	1-3	1	2-4	5-6	1	2-3	4-5	6+	
Corn	X									20
Peas (canned, frozen, or fresh)				X						21
Tomatoes			X							22
Peppers (green, red, hot)			X							23
Carrots				X						24
Broccoli				X						25
Green beans		X	X							26
Spinach		X								27
Greens (mustard, turnip, collards)		X								28
Squash, orange or winter		X								29
French fries, fried potatoes	X									30
Potatoes (baked, boiled, or mashed)			X							31
Sweet potatoes or yams			X							32
Cabbage or coleslaw		X								33
Lettuce salad				X						34
Salad dressing or mayonnaise					X					35

2 1 2 4 0 0 0 — (10)

	last 4 wks		each week			each day				
Number of times	0	1-3	1	2-4	5-6	1	2-3	4-5	6+	
Chips (potato, corn, others)		X								36
Nuts	X									37
Cookies or brownies			X							38
Cake or cupcake		X								39
Pie (pumpkin, sweet potato, or squash)		X								40
Other pie	X									41
Jello		X								42
Chocolate candy				X						43
Other candy			X							44
Coffee or tea		X								45
Soft drinks		X								46
Sugar-free soft drinks	X									47

Mark only one X for each food

How often did you eat a serving of these foods during the past 4 weeks?

	last 4 wks		each week			each day				
Number of times	0	1-3	1	2-4	5-6	1	2-3	4-5	6+	
Baked beans or chili beans	X									48
Other dried beans, peas, or Lima beans	X									49
Rice			X							50
Spaghetti or other pasta with sauce	X									51
Pizza		X								52
Macaroni and cheese	X									53
Hot dogs					X					54
Hamburgers, meatballs, or meatloaf					X					55
Canned tuna			X							56
Cold cuts (baloney, ham, salami)			X							57
Peanut butter										58
Bread, toast, or rolls				X						59
Margarine or butter										60
Chicken or turkey					X					61
Pork chops, roast pork, or ribs	X									62
Steak or roast beef					X					63
Fish		X								64
Liver		X								65
Sausage				X						66
Bacon	X									67
Hot cereal or grits										68
Cold breakfast cereal										69
Donut			X							70
Sweet roll or muffin		X								71
Pancake, waffle, or French toast	X									72
English muffin or bagel										73
Biscuit		X								74
Cornbread or tortillas	X									75
Vegetable soup				X						76
Other soup		X								77
Crackers		X								78

How many eggs do you eat in one week? ③

3	2	2	0	3	0	0	X

②	②					4	0

4	3	2	1	0	0	0	0	—

ID: W1B DATE: 6/25/91 AGE: 30.0

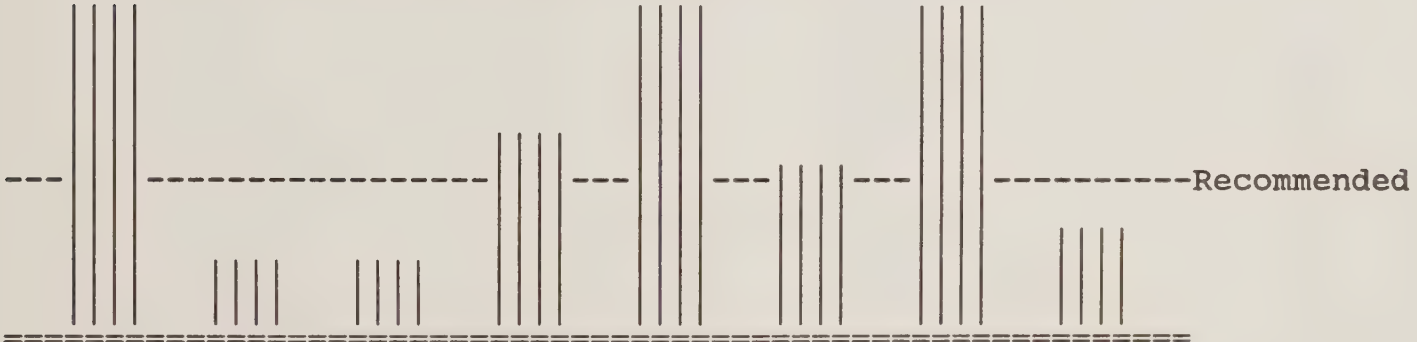
DOB: 6/25/61 EDC: 11/19/91 STATUS: Pregnant

MEAN SERVINGS PER DAY BY FOOD GROUP

Food Group	Servings per day
Milk products	0.7
Fruits	2.4
Vegetables	2.0
Breads and cereals	0.5
Meats and dried peas and beans	3.1
Vitamin A-rich food	0.8
Vitamin C-rich food	1.6
Sweets	1.9
Fats	2.6

Items selected 58
Items without response 5

NUTRIENT DENSITY COMPARED TO STANDARD 1 (RDA)



Protein	Calcium	Iron	Zinc	Vit A	Vit B6	Vit C	Folate
220%	58%	51%	138%	284%	109%	300%	64%

Total estimated calories 1517

ID: W1B DATE: 6/25/91 AGE: 30.0

DOB: 6/25/61 EDC: 11/19/91 STATUS: Pregnant

MEAN SERVINGS PER WEEK REPORTED BY FOOD

Milk	2.0	Pumpkin Pie	0.25
Hot Chocolate	0.0	Pie	0.0
Cheese	2.0	Jello	0.25
Yogurt	1.0	Chocolate	2.0
Ice Cream	2.0	Candy	1.0
Pudding	0.0	Coffee, Tea	0.25
Orange	5.0	Soft drinks	0.25
Orange Juice	2.0	Sugar-free drinks	0.0
Apple Juice	1.0	Baked Beans	0.0
Juice Drink	5.0	Dried Beans	0.0
Bananas	0.25	Rice	1.0
Apples	1.0	Spaghetti	0.0
Grapes	0.25	Pizza	0.25
Peaches	2.0	Macaroni	0.0
Strawberries	1.0	Hot Dogs	5.0
Cantaloupe	1.0	Hamburger	5.0
Water Melon	1.0	Tuna	1.0
Pineapple	2.0	Bologna	1.0
Raisins	0.0	Peanuts	-1
Corn	0.0	Bread	2.0
Peas	2.0	Butter	-1
Tomatoes	0.25	Chicken	5.0
Peppers	0.25	Pork	0.0
Carrots	2.0	Beef	5.0
Broccoli	2.0	Fish	0.25
Green Beans	0.25	Liver	0.25
Spinach	0.25	Sausage	2.0
Greens	0.25	Bacon	0.0
Squash	0.25	Cooked Cereal	-1
French Fries	0.0	Cold Cereal	-1
Potatoes	1.0	Donut	1.0
Yams	1.0	Sweet Rolls	0.25
Cabbage	0.25	Pancakes	0.0
Lettuce	2.0	Muffins	-1
Mayonnaise	5.0	Biscuits	0.25
Potato Chips	0.25	Cornbread	0.0
Nuts	0.0	Vegetable Soup	2.0
Cookies	1.0	Soup	0.25
Cake	0.25	Crackers	0.25
		Eggs	3

Note: Code -2 represents multiple checks on a food.
Code -1 represents no response.

☆U.S. Government Printing Office : 1992 - 311-367/60213